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BULLETIN

OF THE

UNITED STATES FISH COMMISSION.

VOL. V,

748

FOR

1885.

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JOINT RESOLUTION authorizing the Public Printer to print reports of the United States Fish Commissioner upon new discoveries in regard to fish-culture.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Public Printer be, and he hereby is, instructed to print and stereotype, from time to time, any matter furnished him by the United States Commissioner of Fish and Fisheries relative to new observations, discoveries, and applications connected with fish-culture and the fisheries, to be capable of being distributed in parts, and the whole to form an annual volume or bulletin not exceeding five hundred pages. The extra edition of said work shall consist of five thousand copies, of which two thousand five hundred shall be for the use of the House of Representatives, one thousand for the use of the Senate, and one thousand five hundred for the use of the Commissioner of Fish and Fisheries.

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UNITED STATES COMMISSION OF FISH AND FISHERIES,
Washington, D. C.

For the purpose of utilizing and of promptly publishing the large amount of interesting correspondence of the Fish Commission in reference to matters pertaining to fish-culture and to the apparatus, methods, and results of the fisheries, Congress, on the 14th day of February, 1881, by joint resolution (H. Res. 372), authorized the publication annually of a Bulletin, a portion of the edition to be distributed signature by signature, and the remainder in bound volumes. The present volume is the fifth of this series, and contains many announcements which are believed to be of great importance in relation to the subject in question.

Mr. Chas. W. Smiley is the Editor of this volume.

SPENCER F. BAIRD,
Commissioner.

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BULLETIN.

OF THE

UNITED STATES FISH COMMISSION.

1885.

1.—NOTE ON THE MALE ORGANS OF THE EEL.

By JOHN A. RYDER.

Through the courtesy of Dr. T. H. Bean, curator of the ichthyological department of the United States National Museum, I have been enabled to study the male generative glands or Syrskian organs of a species of *Anguilla*, taken at Fire Island Beach, Great South Bay, Long Island, by himself and party during the latter part of the summer of 1884. Four specimens handed to me for investigation proved to be males. Two of these bear the Museum number 35979, taken October 7, and two others, the number 35935, taken September 25. In all four I found the lobulated organs, first described by Syrski, in a condition of development which leaves no doubt whatever that they are truly the male generative glands of the animal.

In the females hitherto examined by the writer the generative folds attached along either side of the mesentery on the dorsal wall of the abdomen are found as continuous folds, lobulated on their external faces, and are mostly composed of very young ova, fat cells, and very little or no connective tissue or ovarian stroma.

In the generative organs of the male specimens alluded to above the glands extend along either side of the mesentery, in the same position as in the females, but the structure consists of very distinct reticule-shaped lobules, which connect at their bases with a common *vas deferens*, which extends along their bases and opens posteriorly into a triangular space, which in turn opens into the common genito-urinary outlet.

Syrski states that these lobulated organs are filled with granules, which are confined to compartments separated by fibrous membrane. I may say that this description is in general terms correct, but I would in addition point out the fact that these compartments are more or less convoluted, long, and tubular, and therefore present the character of

true spermatic tubuli, as may be seen from the accompanying figures. It is thus evident that there can be no shadow of doubt but that these are truly the male organs of the eel, for I find that the granules alluded to by Syrski are really the heads of what in future will probably become spermatozoa, for they are globular and nearly uniform in size. The whole character of the organs, both macroscopically and microscopically, is so entirely different from that of the ovaries found in the female that there is no possibility of confounding them.

Another important fact I would point out, namely, that the Syrskian lobules of the testicle of the male eel correspond almost exactly to the muscular and skeletal segments of the animal, a trait which is not discoverable in the female organs, and one which illustrates a singular fact in morphology, viz, that metamerism may show itself in the glandular part of the reproductive organs of one sex and not manifest itself in the structure of the generative apparatus of the other.

Fig. 1.

Fig. 2.

In the accompanying figures there is undoubted evidence of the existence of something analogous to seminiferous tubules, in the solid strands of adherent and immature spermatic bodies; how nearly the spermatozoa are mature must, of course, remain an open question. The Fire Island specimens were taken near the shore, in one to two fathoms of water, during the month of September. Another series of specimens from Wood's Holl, Massachusetts, bearing the Museum number 29959,

taken in November, 1881, show the Syrskian organs slightly larger than in the Fire Island specimens, indicating possibly that functional maturity of the male organs is not attained till midwinter. This is rendered all the more probable from the fact that the young eels about 2 inches long which constitute the swarms which come into fresh water in the spring must have had three or four months during which to grow in order to reach the dimensions which they attain, which would render it probable that actual oviposition occurred sometime during the months of December or January.

For a full account of what has been hitherto known in regard to the breeding habits of the eel, the reader is referred to a paper by G. Brown Goode, entitled "Notes on the Life history of the Eel, chiefly derived from a study of recent European authorities," and published in the Bulletin of the United States Fish Commission, I, 1881, pages 71–124. The only points which the writer has more fully elaborated are such as relate to the finer structure of the male organs, and he also takes pleasure in announcing that the male eel has been positively identified from at least two points along our eastern coast, the animals in both instances showing the male reproductive elements so far advanced in development that there can be but little doubt if the animals had been taken a few weeks later, ripe spermatozoa would have been found in the *vasa deferentia* of the testes.

EXPLANATION OF FIGURES.

Fig. 1. Vertical transverse section through one of the Syrskian lobules of the male eel, showing the spermatic masses *s s*, the peritoneum *p p p*, which invests the testes and is reflected over the abdominal parietes on either side of the *vas deferens r*, which has two vessels *vs vs* almost underlying it. From the Fire Island specimens. X 35.

Fig. 2. More magnified view of a portion of a section of the testicle of the eel, showing the outer layer of peritoneum *e* with the septa *st st* extending inwards between the spermatic masses, and which thin out into the very thin partitions *pp*. From a Fire Island specimen, X 200.

2.—THE PORPOISE FISHERY OF HATTERAS, N. C.

By F. W. TRUE,

Curator, Department of Mammals, United States National Museum.

THE SPECIES CAPTURED.

The primary object of my visit to Hatteras in September last was to determine whether the species of dolphin captured at that point was the same as that described by Professor Cope under the name of *Lagenorhynchus perspicillatus*, and, if so, to obtain material to confirm or dispel my suspicion that this species is the same as the *L. acutus* of Gray.

I also proposed to collect as much information as possible relative to the fishery.

Upon arriving at Hatteras I discovered that the village was located on the sound side of the banks (as the outlying ridge of sand-hills is called), while the fishery station was on the ocean side. The labor of a walk of 4 miles through the sand was amply repaid, however, by the discovery of scores of skulls and fragmentary skeletons scattered along the beach in the neighborhood of the station, although they were not of the species which I hoped to find. An examination of these remains furnished conclusive proof that the only species captured is the common bottle-nosed dolphin, *Tursiops tursio*. Not a single fragment of any species of *Lagenorhynchus* was to be found, and the fishermen did not recognize my drawings. This seems to me somewhat remarkable since a large series of skulls of *L. perspicillatus* was sent to the Museum a number years ago by Drs. Coues and Yarrow, from Fort Macon, which is not very far distant from Hatteras. I can only suppose that the latter species is a rare visitant in this region.

The bottle-nose dolphins captured are of all ages and of both sexes. The largest skeleton which I found measured 8 feet 7 inches in length. The animal was evidently aged, for the teeth were worn down nearly to the base of the crowns. The largest skulls measured 20 inches in length.

I neglected to mention above that the fishermen recognize a Spring "run" of dolphins which they term "tassel-fins," for the reason that they have long filaments attached to their fins. The animals are said to be very thin. I suspect that these "tassel-fins" are simply specimens of *T. tursio*, to which some lernean parasite attaches itself.

I collected, and have sent to Washington, about a dozen skulls and a large number of scapulæ, pelvic bones, and cervical vertebræ, including two abnormal specimens. All the skeletons were defective, and as we already have specimens in the Museum, I did not regard it worth while to collect any.

THE HISTORY AND METHODS OF THE FISHERY.

Porpoise-fishing has been carried on at Hatteras for at least a hundred years. The methods employed are quite simple, but show a knowledge of the habits of the prey. The season opens in November or December, when the porpoises are very fat. A station has been established at a convenient point on the beach, and signal poles are erected at a distance of 2 miles in either direction. The apparatus employed consists of four or six boats (resembling whale-boats), four or six nets of 18-inch mesh, and 100 to 200 yards long, and two or more fine-meshed sweep-seines.

When the preparations for the fishery are completed, a man is stationed on each signal pole and the boats, each carrying a single net, are placed as represented in the accompanying figure. (Fig. 1.)

The nets carried by boats A and B are fastened together, and the men rest on their oars and await signals from one of the distant poles. If the man on the pole toward the north (N) displays his "waif" in a manner showing that a school of porpoises is approaching from that direction, the men in the boat B commence rowing toward the position occupied by D, paying out their net as they go. At the same moment the men in boat D row southwestward toward the beach, likewise paying out their net. As soon as the porpoises have passed to the south of the position occupied by boat C, that boat and A repeat the movements of B and D, but row in a northwesterly direction. The porpoises are thus entrapped in a huge pound, as shown in Fig. 2. The nets themselves do not reach quite to the beach, but the fishermen find that by thrashing the water with the top lines, they are able to prevent the porpoises from escaping.

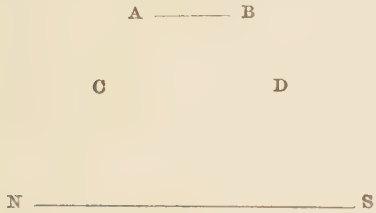

FIG. 1.

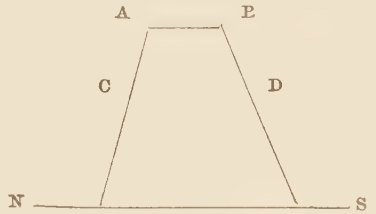

FIG. 2.

The schools thus entrapped frequently consist of 200 or 300 individuals, the power of which is so great that if they should rush violently against any part of the net it would immediately break. The nets are not, therefore, hauled to the beach, but remain in their original position, except so far as they are carried northward or southward by the tides. The actual capture of the porpoises is effected by means of sweep-seines, sufficiently large to contain 30 to 40 individuals. The operation occupies several hours. Very few individuals escape, and these mostly by leaping over the nets, breaking the meshes, or running out near the beach.

When captured, the porpoises, if not drowned, are killed by stabbing with knives. The flippers and dorsal fin are cut off and thrown aside. The skin and blubber are then stripped off together, and cut in pieces for the try-kettle. The mandible is removed and its oil dried out separately.

The process of rendering the oil, so far as I could learn, is of the simplest character. The amount obtained from a single individual does not average more than 6 or 8 gallons. The price per gallon received has not hitherto exceeded 40 cents. The product has usually been marketed in Elizabeth City or Norfolk.

The fishery will probably undergo certain important changes in the immediate future, from the fact that a Northern company has contracted to purchase all the porpoises captured during the next five years. In

consequence, the fishery which has languished for many years will probably be prosecuted with great vigor during the coming season.

NOTE UPON THE SCRAGG-WHALE.

Upon extending my inquiries in various lines, I discovered that the fishermen recognize a certain whale under the name of "scragg-whale." I could not satisfy myself as to what it really is. It was described as being smooth on the back and having short, dark whalebone. Is it Cope's *Agaphelus*, or some other species of fin-back or hump-back whale?

WASHINGTON, *October* 10, 1884.

3.—THE LABRADOR FISHERIES.

By W. A. STEARNS.

COD FISHING.—The men engaged in the Labrador cod-fishery are of two classes, the employers and the employed. The employers all along the coast are generally men who coming here poor have earned their way by hard work and "luck" to a position of more or less independence, or have been sent as agents from some firm of merchants abroad to hire men and conduct a fishery, large or small, as the wealth of the firm or the accumulation of business may allow. There are several of these foreign firms on the coast, notably those of Natashquan and Magpie, and much further eastward of Blanc Sablon and Isle la Bois; these, I believe, are all owned by merchants from Jersey in the English Channel. Among the many who have lived on the coast and worked up a business of their own, the establishment of W. H. Whitely, the magistrate for this part of the province of Quebec, is the largest; as the smaller "rooms," as these establishments are called, are simply a repetition of the larger ones on a smaller scale, a full description of that owned and conducted by Mr. Whitely will give you a pretty good idea of all.

The men employed in the fishery here are either hired from the surrounding families or from Newfoundland. The home men are rough, hearty, healthy, and good-natured, and those from Newfoundland, generally speaking, are large, robust, rough men in most every respect. They are apt to be quarrelsome, and in many cases, I sadly fear, the habit of taking whatever they see that they wish and can safely get away with is very strongly embedded in their nature. When detected they seem, like the ancient Spartans, to regret being caught more than to have taken what was not theirs. Yet many are the reverse of ill-natured. All are strong and accustomed to endurance that would wear out any ordinary individual, while it just seems to fit them for their work. Having employed some thirty or forty men the season before, the next thing is to get everything in readiness for their reception and

work the approaching season. Part of the men work on wages, while most of them work on shares, the share being a certain per cent., say one-third or one-half of the fish caught by them during the season, the other part of course going to the employer. During the winter months the nets are netted or mended as the occasion may be; while in the spring the buildings containing the sleeping apartments or bunks—arranged barrack fashion like the berths of a ship's cabin—and the eating-room and cook room attached are put in order. In the winter also the nets, lines, hooks, &c., are all prepared for immediate use as soon as the season opens. In the spring, again, the boats are taken from their storing place, thoroughly repaired, repainted inside and out, the sails and oars mended or furnished anew if so required; when dry they are launched and moored by sunken buoys at a short distance from the stage-head. The stage itself is repaired, new props and foundation logs often being required as well as boarding for the floor proper, and fully cleaned; the empty puncheons, hogsheads, and barrels arranged to occupy as little space as possible in some sunny position, while the sheds are also cleaned and swept. By the 1st of May, or the breaking up of the ice in the bays and harbors, everything is ready for the advent of the summer fisheries.

We will now consider that the summer has begun, that the time is the first day of June, and that the men are arriving ready to begin work. Rough-looking fellows they are indeed. Tall and short, stout and broad, full-faced, full bearded, and correspondingly fleshy in proportion. They are dressed quite alike, with suits of good thick cloth in the shape of jumper and trousers, over which are hauled the overalls and frock when in working trim on the shore, or oil jacket and pantaloons with an old "sou'wester," as it is called, or rubber hat with a huge rim that hangs over the body, allowing the rain from it to drip, at least on the oil garments if not completely over them on to the ground. Four-fifths or more of the men wear a thin belt and sheath-knife buckled around their body, which, however, is used more for appearance sake than anything else. It has been reported that occasionally on board some ill-managed crafts, these knives are used for weapons of offense and defense, as the case may be, but I have not heard it proven here at least. Though the men look fierce and ill tempered, they are generally of a better disposition than they are usually given credit for being.

The first thing that a man asks for in Labrador on going anywhere is something to eat. No matter if he has just arisen from a table of plenty at the house of some friend, he can always find room for more. I have seen some of the largest eaters I ever beheld in my life while upon this coast. One man boasts of having eaten six ptarmigan—a bird about the size of our ruffed grouse or larger—at a meal; another says that he could eat a dozen herring at a meal, a fish about the size of a medium-sized mackerel, and, judging from what I have seen, I have no doubt but that he could do it. Still further, one fellow, upon testing some maple

sugar, declared that he could eat 10 pounds at one time, while at another time I was offered a bet of 2 shillings 6 pence by a fellow who said he could eat 4 pounds of raisins at a sitting. The paradise of a Labrador man seems to be enough to eat and plenty of tobacco. The Newfoundland men, when coming to Labrador, do not differ much.

While we are talking two boats with two fellows in each who have been out all the morning looking for fish approach the stage-head evidently deeply loaded. An ordinarily constructed stage-head consists of a platform raised upon piles driven into the mud or sunk with huge stones for ballast to the bottom where, at high tide, the water is from 6 to 10 and at low 2 to 3 feet deep. While the men are unloading their fish, by throwing them from the boats on to this wharf with huge pitchforks, it might be of interest to follow a party of fishermen just going out to the fishing-grounds and see what luck they have. The boats used in the ordinary fishing are of two kinds; those called "novies," or Nova Scotia boats, being long and narrow, shallow, and carrying no ballast, which, should she overturn, it would be impossible to sink her since she would immediately right again even if full of water; and those called "Yankee barges," or boats brought here from the States, or made here but to a similar pattern; these are very wide for their length, and correspondingly deep. With the barges the seats are so arranged that they form five partitions, the center one is heavily ballasted with rocks. Of course, should one of these boats be upset or fill with water, it would instantly sink to the bottom. Strange to say, the barges are in more demand than the novies, from the fact that while the former hold 8 quintals of fish freshly caught, the latter hold only 4, or one-half the quantity. The men choose to risk their lives rather than lose their fish, and principally for this reason, that when the fish bite well they can load their boat without stopping to run several miles home in a calm, pulling at the oars all the way, to unload and return, often to find the fish gone or darkness approaching. Fish are uncertain creatures; the fisherman must take advantage of every possible chance to secure enough to procure him his winter's supply of food, as well as to pay up the old debts and what he is consuming during the summer.

I have said that most of the fishermen use the barge, but since many of them still prefer the novie from its lightness and the ease with which it is managed, as well as the expense, which is about one-third less, let us suppose that two parties, of two men each, go out fishing together, the one in a novie and the other in a barge. As no ballast is required for the former the inside room is divided into four partitions, with seats between, while the latter has five, the middle one containing the ballast. Each end of each boat contains a "cubby," or sort of low shelf closet, boarded around at each end (at both bow and stern), wherein are deposited the oil clothes and the dinner of bread and butter and salt pork, with a small keg of fresh water—since the men often start out at 2 or 3 o'clock in the morning not returning until the same time in the

afternoon, this is a necessary precaution, the stay being according as the fish bite well or poorly. After reaching the fishing-grounds the men "down sail," out grapline—a sort of five-barred iron, with curved prongs, which serves as an anchor—and prepare their hooks and lines for fishing. The hook is a large, heavy iron or steel affair, usually several inches long and quite wide at the end; the line is small for shallow and heavy for deep-sea fishing, with a huge lead sinker attached. The bait for the cod are of two kinds. Early in the season the capelan, a fish some 6 or 8 inches long and about the size of our well-known smelt or frost-fish, and much later the "seruse," a species about one-half the size of the capelan. Each species must be hauled fresh every day, usually the night before, either in a seine for the purpose, or in a dip-net when the fisherman is not able to procure a seine. Of course the boats that we are following are well supplied with bait, and the men having baited their hooks, throw them overboard, and wait the result with impatience. Each man stands in the outer hollow of his boat, he tends a line on each side and sometimes two, while as soon as a fish is caught it is hauled in and, being thrown forcibly over a crane in the shape of a figure Y with an iron bar between the ends, which tears the hooks from the gills, it falls into the hollow beyond. If the fish bite well the sport now begins to be lively. As fast as a hook is baited and thrown into the water one of the others is generally ready to be hauled in. To haul this up quickly, hand over hand, fling the line over the Y, thus depositing the fish in the hollow, rebait the hook and fling it out again is the work of but a few moments. Meanwhile, perhaps one or all the other hooks have fish upon them, and the catcher is obliged to fly from one to the other with the speed of lightning. If the shoal fishing is bad the boatman hauls up his anchor and goes out into the deep water. Here he laboriously throws his line into 30, 40, and even 70 fathoms, or 420 feet of water; add to this a heavy leaden weight of 8 or 10 pounds to counteract the effects of the tide and currents, and a struggling fish of 50, 60 or more pounds, as I have often seen these immense deep-sea fish, all to be drawn quickly, hand over hand, the line, small at best, cutting deep into the fingers, and you begin to see that cod-fishing is no easy matter. After all this hard exercise, let them row their boat home in a calm or beat about in a dense fog, as is often the case, for 6, 8, or 10 miles, and you are certain that the work is not all sport. Again, if a crew started off early and have forgotten to take any food with them, hoping soon to be back, and the fog and rain have kept them out all day, until wet to the skin, in spite of oil clothes, and very hungry and tired, they do not return until late into the night, it will be easy to see that these men must possess an endurance almost beyond comprehension, to live, thrive, and grow hearty under such treatment from wind, tide, and weather; while a few hours' sleep, just as they are, prepares them for the next day. Such, then, is the continual life of a Labrador fisherman during four months in the sum-

mer season. All the rest of the year they do nothing but eat, smoke, and sleep. One may safely call their year a period of seasons of summer and winter, with three months of the former and nine of the latter.

By this time the two boats at the wharf have been unloaded, and the workmen, returning from their dinner, are preparing to cure the "catch." The least number that can conveniently cure a lot of fish is three, when the work is pressing, for if a large quantity are brought in they must be done immediately or they will soften and spoil, or with business unusually lively, six men are necessary. For the purpose of cleaning the fish a small house is often erected on the stage-head. This consists of a low, open shed, in the center of which is a long, wide table, large enough to be occupied by two sets of three men each. On the left of the first man is a deep box, one-half of which extends outside of the shed on the platform where the fish are thrown from the boat; the man stationed by this box is called the "throat-cutter," a truly terrible name were it applied to any but one who manipulates fish. Next to this man and on the same side is the "header." Opposite stands the "splitter." The crew is now complete inside the shed; outside the men are heaving the fish on to the wharf with their long-handled and long-tined pitchforks, while a small boy, or some one not otherwise occupied fills the boxes which, as I have said, lay half outside and half inside the shed. The box being full or partly full the throat-cutter takes up one of the fish and lays it upon the table, placing his forefinger in the eye and laying his thumb upon the chin or into the hollow just beyond the chin and beneath the tongue he presses the head downward, thus opening up the gills. This is a matter more easily understood when seen than when described, but I think you will understand how pressing down, outward, or to one side will throw open the natural cavity in the throat of any fish, exposing the gills—at least a simple experiment on any fish will show it. With a sharp knife the fleshy rib of the tongue is cut through at a single stroke; another stroke severs the flesh down the belly; while a third one lays open all the inside and ends in a gash, about 3 inches long, beyond the intestines and beyond and to the left of the ventral fin. The knife used for the purpose has a short, thick, round handle, while the blade is about 5 inches long, generally less than an inch wide at the base and tapering to a rounded point and sharp as a razor on either edge. Thus cut the fish is passed to the header. As this work requires great strength a proportionately strong man is taken for the purpose. He wears woolen mittens or half gloves upon the right hand, and seizing the fish, with a scooping motion of the right hand, he separates the liver from the rest of the insides and pushes it either through a small hole in the table or over at the edge into a barrel beneath, while, taking hold of the fish again with the same hand, he tears out all the remaining insides with the left hand and presses them with the head against the edge of the table, which is hollowed or scooped beneath—often

with a piece of iron placed across the area to be used as a more durable edge—he forces the body of the fish forward with the right, and the head downward with the left, thus tearing it from the body and separating the two; the head and internal parts hanging to it drop to the floor and fall through a hole about a foot square into the water beneath the stage-head. The fish then passes on to the splitter. The splitter taking it, lays it against a small stick nailed to the table, which simply acts as a support to keep the fish from slipping, and with his knife, a long broad and slightly concave blade, well sharpened on one side only, lays the fish open from the end of the cut made by the throat-cutter completely or nearly to the tail; with another stroke he cuts through the flesh and ribs on the upper side of the bone to the top; he then gashes through the bone at a distance about two fifths from the end of the tail toward the head, the fish lying meanwhile with its tail to the right, and continues, with a scooping cut, to sever the flesh and ribs on this side to the upper end; then a peculiar lift of the bone and shake of the arm sends the fish into a coarsely constructed wheelbarrow at the right, while it sends the piece of backbone thus cut out, with the dark inside lining of the belly, or "sound," as they call it, into a pile through a hole at the left. This, then, is the process of cleaning. When the fish have been taken in a net, a seine, or trap, and are unusually large and nice, they are thrown into a tub of water and washed carefully before being salted down; but this is done only in the case of extra nice ones. It will thus be seen that the process of cleaning fish is a purely mechanical one, and the number that these men will clean in a day quite large, especially if they have nothing to do but this work, and the box is kept full of fish. In a large establishment this is usually the case, but in a small one the men are often obliged to keep their own box filled, and afterward to do the work of others.

The barrow being full of fish they are wheeled to the stage to be salted down. Here, also, a regular system is employed. The fish are laid down in four rows upon the floor, from end to end of the building, the heads alternating with the tails in every other row. This makes an even row about 4 feet deep, and with a length corresponding to the length of the building. The next process is that of salting. The salt purchased of the trading vessels is the coarse, granular rock-salt, as it is called, such as is bought in the States usually for ice-cream freezers and other purposes. It comes in bags, barrels, or in bulk when large quantities are purchased. It is deposited in large bins from whence it is wheeled in barrows to the salting-room and shaken from large wooden shovels upon the completed row of fish ready to receive it. Upon this another layer is laid which receives a salting similar to that of the one before it, and so on, a layer of fish, another of salt, until the row is about 4 feet high, when another is begun in front of that one, and so on until the fish or salt are exhausted, or the room, generally low, is too full for more. In this exercise the days, and often the nights,

are employed by the Labrador fishermen. I say nights, and this is often strictly true; the fishermen sometimes do not return with their loads until late in the evening, when the work extends far into the night by candle and lamplight, since the fish would become soft if left for so short a time even as over night out of the water. On rare occasions the fish are placed in bags, which are then moored out in deep water. In this way they keep a long time, but it is rather a tedious and troublesome operation, and one seldom employed unless the quantity taken is far in excess of the workmen employed.

Cod-liver oil is an article in great demand all over the world, but I often think that could one look back of the final distillery, which of course purifies every particle of the oil, they would not enjoy a very pleasant prospect. As it is our honest endeavor to follow the cod-fishery to its legitimate end, one cannot well avoid touching upon the subject in question. It is truly a sight to watch the huge puncheons and vats filled with the cod livers, and note from day to day how the rays of the sun, pouring their strength upon the mass, gradually decompose it and send the dark, thick, rich oil to the surface. The oil will begin to gather in two or three days, or more quickly if the days are extremely hot, when it is dipped up with a ladle and strained, if necessary, into large barrels provided for the purpose. It is generally reckoned that a quintal of fish (pronounced kental) will furnish a gallon of oil, but sometimes the livers are of a poor quality and will not produce so much. At the end of the season the blubber remaining from the livers after all the oil has been extracted is used, boiled, to rub over the roofs of houses, and is an excellent material to prevent the rain from soaking through. It is also saved and fed to the dogs during winter mixed with other food. It is thus that Labrador people learn to economize and use even those naturally waste productions, the remnants of their season's profit. You can easily imagine the scene a lively one when thirty or forty men are engaged in putting away a day's catch of some ten or twenty deeply-loaded boats, and the stage is filled and covered with men, fish, and oil; yet this work is not hard, except that it requires continued attention.

The curing process is, however, not yet completed. After a stay of from three to four weeks in the salt, the fish become pretty thoroughly pickled; they are then taken out, put into large trays of water, and pushed about from side to side, pried over and over, and again pushed around in the water until all the salt is washed off of them, when they are spread upon the "flakes" to dry in the sun. Fish flakes consist of a series of long, narrow rows of low posts pounded into the ground, upon which are laid frames composed of slats some 6 feet long, either three-cornered, with the angle pointed upward, or oblong, flat, nailed upon cross-bars about 6 inches apart, the bars usually 2 or 3 feet from each other. Upon these rows of lattice work the fish are laid to dry. They remain spread while the sun is up, but are gathered into

small piles (backs up) at night or in rainy weather. About two good warm days will dry them sufficiently, when they are thrown and packed into a large round pile with the tails in, the center of the circle being filled up with the small lots too irregular or diminutive to pile, and then covered with bark, upon which are placed stones to hold it down. The dimensions of such a pile are usually 5 to 7 feet in diameter and 4 high. Often the ground is cleared and a frame-work of stones made for its support, which becomes a matter of ornament when the fish are removed, and serves, to make the ground look nicely and reflect the taste of its owner. Often very pretty stones are arranged inside the outer rocky frame-work, and shells play no inconspicuous part when they can be obtained. The men, too, take pleasure in saving any choice-shaped colored piece of coral for this "fish garden," as they call it.

The process of weighing now alone remains to be attended to. All fish are reckoned as so many "quintals." The true quintal is a French weight signifying 220 pounds; how its signification became diverted to that now employed it is hard to tell. All along the coast the term means 110 pounds, or, as the merchants claim, 2 pounds extra on each similar lot for full weight, or, since some of the fish may not be quite dry, 112 pounds. It is usually weighed in lots of 2 quintals each, or the original weight of 220 pounds plus the 4 additional pounds for full measure. Such a weight is called a draft. Strange as it may appear, a draft of 224 pounds of fish just caught will very nearly equal a quintal of 112 pounds of dry fish, the shrinkage being about one-half from wet to dry. The fishermen know how many quintals their boats carry, how much each partition holds, the quantity when loaded up to her thwarts, and also to her gunwale. They know how many small fish will make a quintal and how many large ones; how many can be cleaned and salted in an hour; and, strange to say, can tell as far off as they can see whether the men in the boats are catching fish, and about how many fish from the set and position of the boat she has already. I have seen this told quite accurately time and again when the men were out on the fishing-ground, about hauling anchor to return home, and I could hardly perceive the boats themselves as they danced up and down upon the waves at all, yet I am far from being near-sighted. The people here have wonderful eye-sight. They can distinguish accurately objects at an immense distance, and judge correctly in many instances where ordinary people, unaccustomed to being obliged to do so, would utterly fail often of even seeing the object at all.

Such, then, is the nature of the work that occupies the attention of the people along the coast during the summer months. Though statistics are dry and unsatisfactory at best, a few just here may be of interest. In the whole province of Quebec, in 1878, about 300,000 quintals of codfish were sent into the market, valued, in the aggregate, at nearly $1,500,000. The northeastern division, that part from Manicouagan to Blanc Sablon, furnished 160,500 quintals nearly; but further, over 100,000

were taken by the vessels from the United States, Newfoundland, and other provinces fishing here for the summer season only and returning home in the autumn. This leaves a little over 56,000 quintals taken by the inhabitants of the coast for this district, with a value in the Quebec markets of $5, and to the people themselves, as they sell for cash or trade on board the regular authorized agents' trading vessels, of $3. Of course living is cheap here. Little or nothing is paid for land and right to fish; the gear necessary is small, and the outlay only trifling for small establishments, so that nearly all made is the clear gain of expended labor. It must be remembered also that $100 here will go farther than $400 or $500 in the States to these people, whose wants are really few; yet they are a hearty, healthy, and good-natured race. They are entirely different from the French Canadians who abound in the towns nearest Quebec, and seem to be, the farther eastward one goes in the province, a race peculiar in themselves.

In the 500 miles of coast from Manicouagan to Blanc Sablon, already spoken of, there are several large fishing establishments whose yearly catch of cod amounts to some over 1,000 quintals. They all pursue the plan I have described in catching and curing their fish; thus, of course, more or less petty rivalry exists between them. Starting then from Manicouagan and going eastward, the first place of any importance is Caribou Island. Here the catch amounted to about 1,150 quintals; in the same year (1878), Moisie, a little below, took about 1,260 quintals; still further, Sheldrake took 5,850 quintals, the fourth largest catch made on the coast. At Thunder River the take was 3,125; at Savage Harbor, 1,300; at Pointe Ridge, 1,200; Magpie, 8,200; Saint John's River, 7,500; Long Point, 1,050; Esquimaux Point, 2,010; Natashquan Harbor, 1,900; Bonne Esperance, 1,700; Salmon Bay, 6,510; Long Point, 1,270. It will be seen that several of these establishments took much larger catches than the others. Of these, Sheldrake had 73 boats, valued at $4,380, and employing 237 men; Magpie, 95 boats, valued at $5,700, employing 332 men; Saint John's River, 114 boats, valued at $6,840, and employing 358 men, and Salmon Bay 41 boats, valued at $3,110, and employing 154 men.

SALMON.—One of the most important of the Labrador fisheries next to the cod is that of the salmon, though they are by no means as extensive here as they are in the lower Canadian provinces, especially of Restigouche and the Bay of Chaleur, on the south side of the river Saint Lawrence. The salmon go up the river to spawn; returning they are found in the adjacent waters of the rivers along the coast in the late summer and early fall. The number of fish annually captured is immense. The best and in fact only real season for capturing these fish is a few weeks in the early autumn. They are caught in gill-nets, large or small, with a regulation mesh of 6 inches. The nets are placed along shore at the mouth of the river, or across some channel of the stream, and visited every day. The fish entangle themselves in the meshes, which are

made sufficiently large to allow the young fish to escape by passing entirely through them, and are held until the fisherman comes and secures his catch. The fish are then cut open from head to tail, and carefully cleaned inside and out; all the black skin being peeled off the back bone. They are then soaked in fresh water, then in salt brine, and finally packed in barrels. There are seldom more or less than 23 fish to a barrel. As each barrel brings about $12 cash, each fish is valued at 50 cents. This is of course the first cost of the fish.

Salmon-fishing is only in its prime for about four weeks, between, say, July 25 and August 25. This fishing is plentiful all along the rivers on the coast, and there is seldom one that has not several fisheries upon it. I should say that a barrel of salted salmon will average about 200 pounds in weight. Salmon are, other than above, preserved by drying, smoking, and canning. The latter process is rarely if at all employed in Labrador, the other two seldom. They are smoked much as herring are, and dried in the sun much as codfish on the fish flakes. Salmon are caught with the hook and line by those who care to angle for them; and as the rivers and bays are quite full at the proper season, it is a work of pleasure and profit to practice the rod with this king of fish in his native element and at home, when he is most abundant.

A gentleman by the name of Napoleon Corneau, an agent for a firm situated at the mouth of Goodbout River, has given his time and attention so fully to this sport that his record for salmon-catching stands alone so far as I know. I am not prepared to say that the record is the "largest score of salmon ever killed by a single man in the world," but certainly it looks most extraordinarily like it. Within a period of eighteen days, a few years since, beginning July 8, he captured 365 fish, weighing altogether 3,861 pounds. This is an average of over 20 fish a day and also of about $10\frac{3}{5}$ pounds for each fish. The largest fish weighed 26 pounds.

I should add that this last year (1881) a French steamer visited several localities along the coast purchasing salmon from the people fresh from the nets at a liberal price. The fish were submitted to a refrigerating process and packed for shipment to a foreign market. That year the success was sufficient to warrant the captain in making great offers to the people for the following year, but whether the actual sale will permit so expensive an equipment again or not remains to be seen. Freezing salmon may be a success so far as the freezing goes, but can there be found a company or even a single man enterprising enough to risk his capital in building up a trade that it is not at all likely will become general? Do not understand me as discouraging the enterprise, for a flourishing trade ought to be built up in this very business if the first attempts are successful.

TROUT.—The trout-fisheries are conducted much like, and generally in company with, the salmon fisheries The nets used are long and

narrow, while the meshes are from 3½ to 4 inches wide. This enables the smaller fish to escape and retains the larger ones, whose usual size ranges from 3 to 4½ pounds, and from 12 to 14, or even nearly 18 inches in length. These nets are set across the mouth or along the shore of some small bay into which runs a stream of sufficient size to allow the fish to run up to spawn. The bottom of the net is sunk with heavy weights, while the upper side is supported by cork bobs which float upon the top of the water. The net is examined twice a day, and the fish taken from the meshes. They are then slit down the belly and cleaned thoroughly; after being washed carefully in fresh water they are packed in a barrel and salted down carefully. When full the barrel contains about a third salt and water. In some places the people have out a large number of nets, and often catch from a quarter to half a barrel of trout daily; but the latter is a capital day's work and seldom made.

Trout are caught at all seasons, from early in the spring, when the ice breaks up, to late in the fall. They are most abundant just before it is high tide; and their favorite time is from 2 to 4 in the afternoon of a rather windy and lowering day. They at all times seem to prefer cloudy weather in which to be about, and when the wind blows lightly, ruffling the water, and are then caught in greater abundance than at any other time. In some of the bays the trout are so abundant that you can cast a double-hooked line and generally catch a fish almost instantly on each hook. I have in mind a locality called Baie Des Roches, where a small stream comes down into a sort of bay or arm of the sea, and where, in 1875, a party of five of us succeeded in taking with hook and line some 938 fish, large and small, fishing only part of two days. The fish bit at the red and gray flies, and as fast as we could haul them in. About 100 of these would weigh less than half a pound each, the majority between 1 and 2 pounds, as many as 75 of them 3 pounds apiece, and the largest weighed 4½ pounds.

There seems to be three or four varieties or species of trout in these regions, but they have not all as yet been positively identified. They are called here salmon trout, spotted and gray trout, sea trout, and another species, if indeed it be a valid one, called by the people the mud trout. Of these three or four, the sea and spotted and gray trout alone appear extensively as articles of commerce. Trout are caught all along the coast from Mingan to Blanc Sablon, if not to Belle Isle itself. Anywhere about the mouths of small streams these fish are abundant. The large streams are usually so completely filled with salmon nets that trout nets are of no account whatever. In the small places, even, I have known a small boy hardly ten years old to catch from half a barrel to a barrel and a half of trout in a season with one or two small nets only, thus earning from $15 to $20 on this alone. The fish, like all other "catches," are taken by the traders at a nominal price in exchange for food and articles of necessity, and sold in Quebec as grade 1, 2, or 3,

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according to quality as seen by examination of the barrels by the inspection officer.

HERRING.—The herring, of which there are two if not three species, appear in the waters along the coast of Labrador, if it be an open season, late in April or at any rate early in May. The inhabitants begin to fish for them with nets and seines as soon as the ice in the bays has broken sufficiently to allow, while they continue the operation till sometime in June, usually a little earlier than the middle of the month, when the fish, having deposited their spawn in shallow water, return to the deep water again. These fish are called "spring herring." They are poor and thin, and, caught in the very middle of the spawning season, cannot but affect future fishing in these same waters. These fish are of a very poor quality and are generally salted down for the dogs to eat in the winter months, when a suitable provision must be made for them or they will starve. In the fall, however, the fishing is of a much different quality. The "fall herring" appear on the coast about the middle of August and remain about six weeks. They are in excellent condition, and very fat, and equal even to Scotch herring of the best quality. These fish appear in vast bodies and cover the water often for miles.

They occur all along the coast from Blanc Sablon almost as far as Northwest River. Sometimes the fish remain into October; when they do, these later fish are generally unusually fine, and Pierre Fortin, in his report of the fisheries in the Gulf of Saint Lawrence, states that they are nearly always taken with a seine, and that he has himself seen "a seine set by Nova Scotia fishermen, after having been five days in the water, drawn out with 800 barrels of herring."

The largest fish are caught within the above named district, while the "spring herring" are now rarely taken except in some localities in Newfoundland. It cannot be stated positively but it is generally supposed that these spring fish, after depositing their spawn on the Newfoundland coast, are the same which afterward appear fat and large on the Labrador coast. Although the migrations of the herring are not perfectly understood, it is supposed that local and atmospheric changes enter largely into the causes for which the fish will leave a part of the coast suddenly and only appear again after the lapse of years as suddenly as they disappeared.

Although herring are captured with nets and seines, much as other fish are, yet there is a process known as "weir-fishing," which differs essentially. Weir-fishing is conducted as follows: Young fir trees are driven into the soft mud or sand at ebb tide so thickly that their branches interlace each other. When full tide sets in and brings the

fish they are caught in the mass of branches which the brush or weir presents, and the retreating tide leaves them stranded and at the mercy of the fishermen, who soon collect and salt them down in barrels furnished for the purpose by some trader who purchases the fish at a stipulated price. The usual herring nets are generally 30 fathoms or 180 feet long by 30 feet deep, and good fishing fills from 6 to 12 barrels a day, or rather at each haul, which is generally once a day. Seines are generally 100 to 150 fathoms long and about 10 deep, while the "ketch" is according to the size of the school.

With regard to the curing of these fish it is well asserted by Mr. Townsend that "of all mercantile fish herring is the most delicate and tender, and is, therefore, the most liable to damage from the air and heat after they are out of the water. Herring ought to be scaled, washed, and in pickle as soon as possible after they are out of the water; not a moment ought to be lost that can be avoided. The flesh being so delicate and tender, not only injures quickly by exposure, but is much less liable to take the salt. On the other hand, if the herring get into pickle in a clean state before they have been any time exposed they take the salt quicker, and, therefore, preserve much better the natural quality and taste of the fish." On the Labrador coast the herring are generally simply packed in brine in barrels and sent at once to the Quebec markets.

In Mr. Perley's Report of the Fisheries in the Bay of Fundy, the manner of curing herring is thus described: The fish are scaled by being washed in bushel baskets with a square bottom, open like a coarse sieve, the men standing in the water up to their knees. The best fish have very few scales, and only half a bushel of them are taken in the basket at once; they are then salted in large tubs, the salt being stirred through them by hand; the quantity used is half a bushel of salt to two and a half barrels of fish, which are a tub full. They lie in salt twenty-four hours, and are then washed in fresh water to prevent their becoming "salt burnt," after which they are strung on rods, with their heads all one way, and then hung up in the smoke-house. In Clements the smoke-houses are usually 30 feet square, with 14 feet posts and a high roof; no fish hang nearer the fire than 7 feet, but the most careful curers do not hang them nearer than 8 feet. Rock maple is used in smoking; when it cannot be procured ash is used, being considered next best. The process of smoking usually occupies eight weeks; and it requires the whole time of one person to watch the fire and attend to the smoking, in which much judgment and great care are required. The smoke is usually made up at nightfall, unless the weather is warm and wet, during which time no fires are made. In fine weather the smoke-houses are thrown open during the day to cool; and the greatest care is taken at all times to keep down heat, and to render the smoke house as cool as possible by numerous windows and openings. After being smoked, the fish are packed in boxes of the established size; these are 18 inches

long, 10 inches wide, and 8 inches deep, measured on the inside; and there should be 12 rods, or 24 dozen, of fish in a box of prime herring. If the fish are large and of the best quality, it requires some pressure to get this number into a box. The Digby herring are in some instances cured in pickle, unsmoked, and packed in half barrels. Packed in barrels, each barrel is supposed to weigh 224 pounds.

SEALS AND SEAL HUNTING.—There are seven species of seals credited to the coast of Labrador. Of the first, the walrus, or morse, or *la vache marine* of the French (*Odobænus rosmarus* Malmgren, also called the Atlantic walrus, in distinction from the *Odobesus*, or Pacific walrus), I will not attempt to give a history, it being of too irregular occurrence upon the coast to admit it. It is found sometimes in Northern Labrador. Two specimens were captured at Fox Harbor about 1880, and one of the young men in our expedition in 1882 secured the tusks of a small specimen from this locality. The inhabitants here say that they see these animals occasionally in the water, but rarely capture them; that they occur more frequently farther north on the coast, though probably never common. None of the eared seals are known to occur on the Atlantic coast, I believe. The remaining animals are of the family *Phocidæ*, and of these six are generally believed to be found in Labrador.

First may be mentioned the Harbor seal (*Phoca vitulina* Linné). This is one of the smallest of the seal species. Its coat is of a beautiful, soft, and silky texture on its surface, the hairs being darker beneath, and often variously spotted and marked with dark and white spots and blotches. When young they are of a dirty, yellowish white. The specimens of harbor seal usually seen in our country are only young, and rarely exceed 5 feet in length; the adults are occasionally 7 feet or more, as I have several times seen them. Few species have so wide a geographical distribution as this same harbor seal, and its variation in coloration, also, has combined with this distribution to give more synonyms to this than perhaps any other species of the seal tribe. It occurs in nearly every region of our northern hemisphere, and even ascends the large rivers, and is seen in the interior of the country in large lakes and ponds where they occur. It is not a migratory species, at least not extensively so. It lives in the region where it occurs throughout the year. It is confined to near the shore. It rears its young, at least in Labrador, 10 to 20 miles up some river in the interior of the country where there is a sand-bar in the river, and in the early spring as soon as the river is free of ice. It is a very knowing animal, and also a very sagacious one. Seals are captured in nets placed at the mouths of the rivers or near some rocky point of land where the seals are abundant. These harbor-seal nets are made of stout "salmon twine," are 40 to 50 fathoms long, and 6 to 8 deep. The meshes are 6 inches. The nets are moored with heavy weights, and tended about twice a week, as frequent visiting of the region where they are set tends

to frighten the seal. This trapping is carried on in all seasons of open water from spring to fall. This is the only species found on the coast the year around. The skin is worked into all sorts of fancy articles; the blubber makes first-class oil, and the flesh of the young is good eating, if nicely broiled before the coals without the fat. As far as I can learn, the female gives birth to but a single young seal.

In the spring and fall these seals are abundant all along the flats at low tide, where they herd in large numbers. I have seen them thus perched on the flat stones along a few rods of beach so thick that all seemed one black mass of bodies. The least disturbance, and the whole herd flop off into the shallow water and hurry to sea, and in a moment not a seal is left. Soon one hundred heads are seen, in as many directions as many rods from shore, in the surrounding water, and they continue to swim about and watch the intruder till either he goes, or, satisfied that they cannot land again, they disappear to some other chosen spot, or sport in the water at their pleasure. They come ashore mostly at low tide, and in the evening about sunset. They love to bask in the sunlight during the daytime on the flat rocks along shore. They are very hard to kill with shot or ball, but if caught far on land are soon dispatched with even a moderate blow on the end of the nose. They eat fish, often robbing the salmon and probably the trout nets also of the fisherman. They also eat crustacea and small shell fish, shrimps, &c. Some of the fishermen told me that they fed on a species of tender kelps at the bottom of the shallow passes between the rocks and islands, and on small sea animals. Their curiosity is very great, and a peculiar mode of enticing them within gunshot is practiced by the inhabitants, who dress in a black suit, pull a black cap over their heads, and, going to some flat rock, lie over it much as a live seal would do, keeping the face down and the gun ready; the voice is then made to imitate the bellow or rather hoarse bark of a seal. The animal mistakes the person for another animal of his own tribe and gradually swims up to him, frequently diving and appearing again as he swims around; when finally near enough, as the animal dives, the hunter clutches his gun and takes aim at where he expects the seal to appear; the minute it shows its head he fires, generally killing or wounding the animal; he then rushes out to his boat, shoves off, and secures the booty. A seal, if only wounded, will dive and not appear again on the surface of the water unless at a great distance away. If shot dead it will float at once if very fat; if not it rises in a few moments, timed by the fatness or leanness of the animal; the fatter they are the quicker they rise, so that the hunter is sure of his game in the end if he kills it.

The Ringed seal (*Phoca fœtida* Fabricius) is rather rare, as far as I can learn, upon the Labrador coast. It is found all the season around, like the harbor seal, and with it, having also many of its habits. It is distinguished by its smaller size, and it is said, "can always be recognized by the length of the first digit of the manus, which slightly ex-

ceeds all others." This is in all probability the species called by the natives the gra or jar seal. It much resembles the harbor seal, but is even smaller, the adult being about 5 feet long, and the female even less. Several were killed while I was on the coast, but I did not obtain them. I sent word, however, to have them "salted down" for me, and shall doubtless obtain them on my next visit to the coast. It has a peculiar habit of balancing itself and tilting backward and forward when in the water, much resembling the bobbing of a bottle when thrown overboard. It occurs near shore.

The Bearded seal (*Erignathus barbatus* Fabricius) is probably the "square flipper," as it is called here. It is found generally on the ice and is of immense size. Several were captured while I was here. Their average height is 8 to even 12 feet, their weight 500 to 1,000 pounds, and their yield of oil 30 to 40 or more gallons. They occur singly and occasionally, I believe, accompanied by their young, which are found with them just before the breaking up of the ice in spring. It is the largest species of seal found on the Atlantic seaboard. They are regarded as a great prize by the inhabitants, the yield of oil being so large, and the skin furnishing so much material for boots, gloves, mittens, &c.

The Gray seal (*Halichœrus grypus* Fabricius) so closely resembles the bearded seal, first mentioned, that the two are doubtless often confounded. It is credited to the North Atlantic and the straits of Belle Isle as also the Labrador coast, but it occurs so rarely as to deserve no special attention here. It is shorter and the skull much larger than is the bearded seal, which it so closely resembles.

The Harp seal (*Phoca grœnlandica* Fabricius) is the Greenland, or saddleback seal of Labrador and Greenland coasts which, with its next neighbor, the hood seal, affords such rare sport to the seal hunters in the spring and fall of each year. The general color of the male is yellowish white, the nose and face black, as are also several lines forming a fancied resemblance to a harp upon the back of the animal. The female resembles the male, but has the black indistinct or wholly wanting, the yellowish white inclining to grayish to compensate. The young are light golden-yellow or white when born and gradually become dirty yellowish or white, like the adult, as they grow older, but when young distinctly spotted more or less according to age. They are then called "whitecoats," and require five years to mature. Its size is inferior to that of the hood seal.

Of this species, Samuel Robertson, in the Transactions of the Literary and Historical Society of Quebec, in an article entitled "Notes on the coast of Labrador," says: "The harp seal is found from the river Saint Lawrence to the Arctic Ocean, and from Greenland eastward to Nova Zembla. Its usual size is 7 feet in length, 4 feet in girth. For forty-two days the young have the hair yellowish white; it then changes to mottled black and light blue. It grows for three years. They are more

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or less abundant all along the coast, are carnivorous though very abstemious, and when caught rarely have anything in their stomachs; rest alone seems to fatten them. In February or March the mother drops the young on the drift-ice, one, two, or rarely three at a birth. At first they are about the size of a cat, and weigh 14 to 15 pounds. They are helpless and can get no food; they suck the ice, and absolutely fatten with no food. They remain thus helpless on the ice until they have grown there on air to the weight of 70 pounds, when they take to the water, cast their coats, and seek their own food."

This remarkable statement is by one who for a long series of years hunted seals for his living at La Tabatier and other places on the Labrador coast. I am aware that this is in direct opposition to our generally received theories of the growth of these animals, but have great confidence in Mr. Robertson's opinion, as he wrote from experience in an establishment that has made seal hunting its business for the best part of half a century.

An adult harp seal weighs about 400 pounds, its pelt equaling about 5 gallons of oil in value. This species rarely occurs south of the Magdalen Islands. They are migratory, appearing in herds in spring and fall, generally near shore, at stated times, as regularly as the season comes around. The farther north one goes generally the more abundant they become. They appear in vast numbers on the drift-ice, that also holds their young, and both old and young are hunted by sealers from Newfoundland and vicinity in spring upon the ice. Vessels are fitted out for this purpose alone. In 1880 eight vessels secured 22,500 young seal within a few miles of the Newfoundland and Labrador coast, most of which were of this species. They were taken during the month of April. In 1881 the number was 36,000. The yield of oil was from 4 to 5 gallons to each seal. The pelts averaged 80 cents apiece.

The migrations of these seal do not appear to be very clearly understood. They pass southward in fall in small, increasing to large, herds; some winter in the Gulf of Saint Lawrence, where they breed; the majority, however, seek the open ocean and return north to breed on the drift-ice, which floats down loaded with them in April. In May they return north again, but generally far out to sea, returning south again in fall as before. In spring hunting the herd rarely gives the hunter over one or two days; in fall he has as many weeks. The ice fishing occupies a different season of the year.

The harp, as also the hood seal, feeds chiefly upon fish, and to a terrible extent upon young cod, doubtless also herring. The migrations of each of these animals must have a more or less connected origin, be it climatic or what it may; and it is a well-determined fact on the coast that the abundance of one means rarity of the other. Those years when a large "catch" of cod occurs seal are scarce, and *vice versa*. It is a well-established fact that the cod-fisheries of the east coast of New-

foundland are seriously affected if large quantities of seal occur in that region the same year.

The Hooded seal's (*Cystophora cristata*, Nilsson) general characteristics much resemble those of the Harp, though it probably takes much less time to mature. The adult male and female are very much alike, and the hair bluish black without trace of yellow, save the gloss on the surface of the coat, and the light yellow spots all over. Its size is from 7 to 9 feet; weight 500 to 700 pounds; and it produces about the same quantity of oil as the Harp seal. The movable cup or hood which appears upon the head of the male about the breeding season is probably peculiar to that time and sex.

The Hooded seal seems to keep close company in migrations and breeding with the harp seal, and, as far as we can say, many of the peculiarities of the one species are common to the other. They are much less abundant, and more irregular in occurrence than the harp, however. From accounts received from hunters on the coast this is the most dangerous of the seals. When pursued and wounded it will fight fiercely. In migrations the males and females proceed in separate herds, the one preceding the other in autumn by a week or ten days; usually, the females appear first, I believe. This, I believe, is also true of the harp seal.

Seal hunting on the ice along the Labrador and Newfoundland shores, formerly a considerable industry, is now generally conducted by small vessels of 10 to 40 or 50 tons' burden, manned by five to twelve men each. The average catch is from several hundred to several thousand for each vessel. A few large steamers only are now engaged in this enterprise. While on the coast one steamer found an unusually large field of floating ice covered with seals, old and young. The men turned to and killed 5,000 young seals in a single day, piling them upon the ice to be skinned the next day. That night the weather moderated, the ice did not freeze, and the weight of the seals breaking the mass, every seal was lost. The next day the men, not to be discouraged, turned to and before night had again killed as many more, which they proceeded to skin at once, thus saving all.

On the Labrador coast the most noted fisheries are Whale Head and neighboring posts, under the supervision of Joseph Gallishon; La Tabatiere, under Samuel Robertson, whose statement, previously quoted, was of such a surprising nature; Great Mecattina, under Samuel Gaumont; minor stations at Old Fort Island, Bradore Bay, L'Anse des Dunes, Long Point, Five Leagues; and in Newfoundland Labrador, Mr. Davis's establishment at Point Amour. At these various places the catch was chiefly adult harp and hooded seals, with occasionally a "square flipper," and amounted in 1878 to about 2,700. A few of these were young harps, which, in their second and third year, go by the name of "Bedlamer," or "Bellamer," at least on "the Labrador," the very old ones going by the name of "saddlers."

The harp and hood seal are captured in nets made similar to those used for the harbor seal, but of greater length, and about 8-inch mesh, and moored in some similar position. It requires considerable tact to manipulate a seal net. One of the many devices whereby seals are secured is to keep constant watch for the seals. When a herd appears near the nets, shouting and firing of blank charges of powder are begun to keep the herd under water, so that they may the more surely become entangled in the meshes of the net. After a sufficient time the nets are visited and seals not already strangled by the netting are killed with blows upon the nose. Seals will remain under water ordinarily about five minutes, but if pursued or forced to it will remain ten, fifteen, or even twenty minutes, while they will swim great distances without appearing on the surface for air.

Ice hunting is practiced during the last of March and first of April, along the drift, a few miles off the Labrador and Newfoundland coast, though sometimes 60 to 80 miles away even. It has been discovered that it is prejudicial to the interests of the hunters themselves to start too early in the season for the hunting ground, as the supply is greatly diminished by killing the old seal while the young are helpless, even before they are born at all, as was formerly done to a great extent. The system of shares generally prevails here, as in the cod-fishing, everything depending upon the abundance of the seals. When a locality is found full of drift ice, on which the "whitecoats" are particularly abundant, the men land and begin the slaughter. The seals are killed by knocking on the end of the nose. They are then skinned by a relay of men, or, as a rest from the exercise of "clubbing," by the same set. The process of skinning or taking the pelt consists of cutting the animal through skin and fat from nose to tail, while but a short time suffices to remove the carcass, which is then thrown overboard, while the skin with its fat is laid out to cool and partially dry before packing away. An average pelt weighs about 40 pounds, and is about 2½ feet square. The old seals are occasionally caught or shot, being seen everywhere about in the surrounding water, but the slaughter is generally confined to the young. As the pelts are brought on board they are stowed away in the hold, which is partitioned off to prevent the shifting of such a mass of slipping ballast, and when full the vessel starts for home. If the prospect for more seal is good the cargo is quickly unloaded and the vessel returns to renew the work of destruction.

The skins, when landed are "skulped;" that is, the fat is taken off of them and they are salted thoroughly and packed away to be sent to the factory, when they are used for knapsacks, trunk coverings, also shoes, boots, gloves, hats and caps, and a variety of articles when common leather is too thick and rough. In England they are converted chiefly into one of the many varieties of patent leather. The process of making seal oil is simple. The fat is cut into small fragments and put

into vats, to be exposed to the rays of the sun or tried by fire, as the case may be. The young produce the "pale seal oil," the older seal the darker and heavier "straw-colored seal oil." Either kind of oil is then reduced by straining and other refining processes to two or three qualities, each of which brings a price corresponding to its grade. Seal oil is used for a variety of purposes in manufactures, and in many countries is still burned. The seal-hunter, if successful, is never lacking in good, healthful food. Steak from the young seal, if freed from fat or oil, is most tender, and really delicate and delicious eating. It tastes more like fresh cow's liver than any other meat with which I am acquainted, and is highly prized by the natives, as well as by all who have once tasted it when properly cooked.

MACKEREL FISHING.—Mackerel abound chiefly in the Gulf of Saint Lawrence, seldom coming on to the Labrador coast. They are found here occasionally, however, and are then captured and cured as in other places. The time for catching these fish is usually from early in July to late in September. The fish come along shore like the herring to spawn, but are seldom fished until after spawning season, which is usually in the earliest part of summer. It is most numerous in the fall months, when it is extremely fat and well savored. It is taken in nets and seines, and quite large ones at that, many of them capable of holding 600 to 800 barrels of fish. The practice among ordinary fisherman is to use the hook and line; the bait used is a small fish called the pogie, though anything bright will attract them, as a small silver piece placed alone upon the hook. The mode of taking these valuable fish is thus excellently and pleasantly described by Mr. Fortin:

"As soon as the schooners have reached the place where shoals of mackerel are usually found, they keep cruising backward and forward, and the moment there is the least appearance of fish, or their presence is even suspected near a vessel, the jibs are taken in, and the vessel is brought to, with the mizzen-sail and mainsail veered half round. Feed is then scattered all around from small pails, the fishermen seize their lines, bait their hooks with small pieces of the skin of the neck of the mackerel or any other fish (but the mackerel is much preferable), and throw them into the water. The lines are fine, and are made of hemp or cotton, generally the latter. They are from 6 to 8 fathoms long, and one end is fastened to a small sinker of polished pewter, oblong in shape, and weighing about 2 ounces, to one end of which is soldered a middle-sized hook.

"Each fisherman plies the lines, one in each hand, and leans on the rail while fishing. He seldom pays out more than 4 or 5 fathoms of line, for the mackerel, attracted by the chopped fish thrown overboard, thousands of pieces of which float in mid-water, leave the depths of the sea and come swimming toward the surface to feast with avidity on this excellent bait, prepared for him with so much care; while he is gorging himself with pieces of pogie and mackerel, he seizes the bait on

the fisherman's hook, and soon, in spite of his violent efforts to break the iron that is tearing his mouth and to free himself, he is pulled out of the water and thrown upon the deck, where he dies before long.

"Such is the method of taking mackerel with the line, pursued by the American fisherman, and our own, as well as those of Nova Scotia and the other provinces, have adopted it as being the best. But it is far from being invariably successful; for it often happens that the fish, finding plenty of food at the bottom of the sea, will not rise to the bait, or care so little for it as hardly to bite at the hooks. But the great difficulty with the fisherman is to find a shoal of mackerel. It is almost always an affair of chance. When mackerel swim near the surface, as they do when they are pursued by the porpoise or some other of the large fish that prey upon them, they are easily recognized, especially by the experienced fisherman, by the ripple they make in the water, and sometimes the noise they make by beating the water with their tails; and the moment they are seen from the fishing schooners these bear down upon them and make all sail, so as to reach the place where they are as quickly as possible. Then quantities of bait are thrown into the water, and if the fish are hungry a good take may be expected. From 15 to 30 barrels of mackerel, for example, may be taken in a forenoon by a crew of fifteen. But mackerel do not always show themselves near the surface; on the contrary, they generally keep at a great depth, in order not to be seen; and then the fisherman are obliged to seek for them. For this purpose they cruise with their vessels, as I have said already, in certain places from sunrise to sunset; and I should add that in fine weather they stop every half hour, and sometimes oftener, to throw bait into the water, in the hope that some shoals of mackerel may see it and allow themselves to be attracted by it to the surface. The mackerel-fishing schooners, which are almost always good sailors, often sail from 60 to 100 miles in a day on a cruise of this kind; and they can cruise for a week at a time and sometimes longer without taking a single fish."

It is also true that a vessel will remain out almost the entire season and obtain barely enough fish to supply food, while at other times a fortnight good fishing will secure a good load. With regard to curing, the fish are simply washed, dipped in fine salt, and packed in barrels, either whole or split in two, with the flesh downward, salted with coarse salt and pickle; they are then divided into three grades, and priced and sold accordingly.

LOBSTERS, CLAMS, CRABS, &C.—Lobsters are found everywhere along the coast in great abundance. There are factories for canning them, however, only in Nova Scotia and on the Newfoundland coast. Lobsters are caught in one of two ways. When they are abundant, boats are sent out and the lobsters caught in nets, which are stretched over a barrel hoop or some similar frame, and lowered by strings into the water, a piece of cod-head or some sort of bait having been tied down

in the middle of the net. The lobsters crawl upon the net to feed upon the bait, become entangled in the meshes, and are hauled carefully up and out of the water. Very often the beach is covered with rocks, large and small, interspersed with holes and pits filled with water at low tide. The seaweed grows over these places, thus affording capital hiding places. One can often procure 100 lobsters in an afternoon from a strip of this beach hardly as many yards long. The small boys hunt them with long poles, on the end of which are tied large cod-hooks. With these the boys reach in and feel about in the holes and under the rocks until they feel the shell of the lobster, when a smart or careful haul, as the case may need, generally brings the animal out of his snug quarters and at the mercy of his captors. A lobster factory could undoubtedly be set up with profit on some part of the Labrador coast; now a limited quantity are caught and carried over to the Newfoundland factory. The lobsters that I have eaten from the Labrador coast have an unusual sweet and juicy taste, it appears to me. They are seldom very large, while the very young ones appear not to come in shore among the rocks to any very great extent. When boiled at once, and eaten as soon as cool enough, they are most delicious.

Of the other edible invertebrates, oysters do not live so far north and east, the oyster beds of Gaspe being the only successful enterprise of this kind established as yet. Crabs are sometimes caught here and eaten, but they are not as abundant apparently as farther east. Shrimps are common, and may be eaten in a few places, but I have not seen them used here as an article of food. Of the numerous species of edible molluscs, abundant all along the coast, the mussel is a common dish, either baked or boiled. Limpets may be eaten occasionally. Clams are sometimes found in the mud flats, especially along the coast line; and the razor clam is abundant in but one or two localities. They are all used and greatly relished by the people about the coast.

STATISTICS.—The north-shore fisheries of the Saint Lawrence are separated into nine divisions, from Manicoungan to Blanc Sablon, as follows: Godbout division, extending from Manicoungan to Point des Monts, contains 15 stations; Trinity, from Point des Monts to Baie des Roches, 10; Moisle, from Pigon to Jambons, 30; Saint John's, from Sheldrake to Esquimaux Point, 14; Watsheeshoo, from Betchouan to Little Watsheeshoo, 6; Natashquan, from Natashquan River to Nabisippi, 6; Washeccootai, from Kegashka River to Romaine, 7; Saint Augustine, from Coacoachoo to Chicatica, 41; and Bonne Esperance, from Chicatica to Blanc Sablon (the terminus of the Canadian province), 33 stations. The total value of the north-shore fisheries for 1880 was $1,401,289, or an increase on the preceding year of $126,209. The cod fishery was by far the most valuable, amounting to nearly $1,200,000. In 1881 the catch of cod was nearly double that of the previous year.

AMHERST, MASS., *February* 10, 1884.

4.—HISTORY OF OPERATIONS AT THE FISH-HATCHING STATIONS ON THE McCLOUD RIVER, CALIFORNIA, FROM THE BEGINNING, AUGUST, 1872, TO OCTOBER, 1884.

By LIVINGSTON STONE.

In August, 1872, the writer was deputized to establish on the Sacramento or its tributaries a station for collecting and distributing salmon eggs on a large scale. It was too late in the season to take many eggs that year, but the right spot was found and a temporary station erected near the McCloud River, where a few thousands eggs were matured for shipment and transported safely across the continent to the Atlantic coast.

The next year (1873) the station was moved down to the water's edge on the right or west bank of the McCloud River, 2 miles from its mouth. The parent fish were caught in a sweep seine, and the hatching-troughs were put up under large tents erected for the purpose. The water supply was raised from the river by a current-wheel and taken to the hatching-tents in a flume. As the hatching troughs rested on a low bar near the river, it was only necessary to have a wheel 12 feet in diameter. After the spawning season began the seine was run diligently night and day by two separate gangs of men, but notwithstanding the efforts that were made only 2,000,000 salmon eggs were taken. As the run of salmon in the river was abundant this year, and as no pains were spared to capture them, this result demonstrated that 2,000,000 was about the maximum number of salmon eggs that could be collected at the station in a single season by the methods in use up to this time. As the especial object of this station was to collect eggs *on a large scale*, the result, although obviously very large, compared with anything of the kind that had preceded it, was by no means satisfactory.

Accordingly the next year, 1874, a plan was conceived and carried into execution for capturing more parent salmon, by putting an obstruction across the river above the fishing ground which would let the water through but would arrest the upward progress of the fish. This plan succeeded beyond the most sanguine expectations of all. The obstructions, which consisted of a bridge, with a wooden rack or fence reaching from the floor of the bridge to the bed of the river, was erected about the 1st of July, and in a few weeks the salmon swarmed in thousands in the river below the bridge. The problem of getting salmon eggs on a large scale was solved. Nearly 6,000,000 eggs were taken that season with far less exertion than had been expended in taking 2,000,000 the year before. It was an embarrassment of riches, however, for by the old method of hatching salmon eggs in single layers, it would take nearly half an acre of ground to furnish room for hatching so many eggs, or rather for bringing them forward to the proper stages for dis

tribution. To meet this emergency deep trays or baskets were devised, in which, by placing them in a trough that the water had to force itself upwards through, the eggs could be placed several layers deep, and as many hatched over an area of 1 superficial foot as formerly required 12 superficial feet. These new trays or wire baskets, after a little experience, worked to perfection and completely removed what had begun to appear a very serious obstacle, viz, the difficulty of furnishing space enough to carry such an enormous quantity of salmon eggs.

The next difficulty that needed to be removed was the danger of interference from outside parties. The station was on "wild land," and there was nothing to prevent a settler or any one else from camping down beside us and fishing where we were fishing.

The next year (1875), General Grant, who was then President of the United States, helped us out of this difficulty by very prudently making a reservation of such a tract of land as was required for the operations of the hatching station, and thereafter no trouble whatever has been experienced from intruders. Had it not been for this very opportune action of General Grant I think some serious complications would have arisen.

Up to this time we had suffered no small inconvenience, owing to the hatching operations being carried on at so low a level. The hatching apparatus was erected on the low bar above mentioned, to avoid the risk and expense of raising the water supply any higher; but it became necessary, of course, on account of high water, to tear up everything before the rainy season began, and to carry apparatus, tents, and all high enough up the banks to be out of the way of the winters' floods, and the next spring to carry them all back again, and put them in place on the bar. This proved to be such an inconvenience that when the season of 1876 opened, a permanent wooden hatching house—a very solid structure—was built 15 feet above the summer level of the river, and a current wheel, 27 feet in diameter, resting on solid piers, was erected in the river, in place of the 12-foot wheel that had been used before. The new hatching-house was a success in every respect, and so was the wheel till a sudden rise in the river carried it off. The next year (1877) I built a new wheel, and substituted flat boats for piers as a support for the wheel. The boats worked perfectly, and, rising and falling with the water, saved the wheel from all danger by floods.

The next year (1878) this station reached its maximum of operations, 14,000,000 salmon eggs being successfully taken, two car-loads of which were shipped to the Atlantic coast and several million to foreign countries.

The next year (1879) was an uneventful one at the salmon-breeding ranch, but during the season a trout-breeding station was established on the east bank of the McCloud River, 4 miles above the salmon fishery. In 1880, operations were conducted as usual at the salmon fishery, and without much change except that improvements of a

general character were added to the station. At the trout ponds, fishing was pursued vigorously for the purpose of acquiring breeding trout, and 338,000 trout eggs were taken.

In 1881 came the tremendous floods, which mark an era in the history of Northern California. Nothing approaching them in volume or destructiveness had been known since the arrival of white men in that region. Over 9 solid feet of water fell over the whole face of the country that season. The effect was indescribable. The climax seemed to be reached on the night of the 3d of February, when the McCloud River rose 26 feet above its summer level, and, pouring down a resistless torrent, carried away almost every vestage of the salmon-breeding station.

Through the intervention, however, of Hon. B. B. Redding, of the California Fish Commission, and U. S. Senator Booth, Congress made an appropriation for rebuilding the station as quickly as possible. Men and materials were procured, and the work of reconstruction was begun, and before the season was over a new hatching house, mess-house, and stable were erected, and a current wheel, 32 feet in diameter, with two large flat-boats for supports, was placed in the river. The McCloud was bridged over as usual, and the station in all other respects was put in complete running order, and 7,500,000 salmon eggs were taken, most of which were hatched for the Sacramento River. No serious damage was done to the trout-pond buildings this year by the floods, but many of the parent trout were injured by the mud that was washed into the ponds, and only 261,000 eggs were taken.

In 1882 the appropriations from Congress came so late that but little was attempted in the direction of taking salmon eggs. Four million, however, were collected and hatched for the Sacramento River. At the trout ponds 337,500 trout eggs were taken, most of which were shipped to the Eastern States.

In 1883 the Central Pacific Railroad Company laid a track from Redding, north, along the line of the Sacramento River to Sacramento Bridge. The blasting operations of the construction corps prevented the parent salmon from ascending the river as usual, so that, although unusual exertions were made to take a creditable number of salmon eggs, it was found impossible to obtain over 1,000,000. At the trout ponds 389,000 trout eggs were taken.

On account of the unfavorable effect of the railroad blasting on the salmon in 1883, it was decided not to continue active operations at the salmon-breeding station in 1884, which was accordingly kept closed during this season.

At the trout ponds 315,000 eggs were taken and distributed in 1884. This station is still in active operation, and at the present writing promises to yield a good supply of eggs at the next spawning season.

Below will be found tables giving the number of salmon eggs and trout eggs taken at the two stations of the United States Fish Commis-

sion on the McCloud River, California, during the whole period of their operations from 1872 to 1884, inclusive:

Salmon eggs taken.

Year.	No. of eggs.	Year.	No. of eggs.
1872	30,000	1880	7,500,000
1873	2,000,000	1881	7,500,000
1874	5,750,000	1882	4,000,000
1875	8,610,000	1883	1,000,000
1876	7,500,000	1884	
1877	7,000,000		
1878	14,000,000	Total	71,890,000
1879	7,000,000		

NOTE.—As most of the above figures are largely underestimated it is probably safe to assume that seventy-five or eighty million salmon eggs were taken at this station in the twelve years from 1872 to 1883, inclusive.

Trout eggs taken.

Year.	No. of eggs.	Year.	No. of eggs.
1879*		1883	389,000
1880	338,000	1884	315,225
1881	261,000		
1882	337,500	Total	1,640,725

* Station established.

5.—TRANSPLANTING LOBSTERS TO THE CHESAPEAKE*—EXPERIMENTS UPON THE TEMPERATURE THEY CAN ENDURE.

By Lieut. W. M. WOOD, U. S. N.

October 18 I procured from Mr. E. G. Blackford, in New York, 125 live lobsters of small and medium size, many of them being females with a full supply of eggs. They were placed in a tank through which salt water was circulated, but quite a number died the first few hours, being probably in poor condition when received from the market. On our arrival in the Chesapeake, I deposited 63 in good condition and trust they may be heard from in the future. They were deposited off Block River light at 11.30 p. m., October 19.

I tried the following experiments in this connection by means of the ice machine. In a cask containing salt water and maintained at a temperature of from 34° to 36° F. I placed 5 lobsters. At the end of twenty four hours 3 were dead and 2 alive and in apparent good condition.

In the cold chest, kept at a temperature of from 34° to 38° F., 5 others were put. At the end of twenty-four hours 2 were dead, 2 in excellent condition, and 1 rather weak. The 3 latter were allowed to remain another twenty-four hours, or forty-eight hours in all. The weak one was then dead and the other two in pretty good condition

*On a previous planting see report in Bull. F. C. 1884, p. 16.

still. It is possible that the ones which died might have done so any way as the others did in the running water, and I should think, judging from those put in the cold chest that lobsters might be kept alive for a number of days in a temperature of from 40° to 45° or 50°. I think 34° was a little too cold for them. At present I could not well regulate the temperature, but hope at some future day to give it another trial.

I placed several lobsters in water at the freezing point. They were just alive after one hour's immersion, but did not recover when placed in running water. All these lobsters were taken from water at a temperature of 69° and 70°.

WASHINGTON, D. C., *October* 21, 1884.

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6. DIRECTIONS FOR COLLECTING EMBIOTOCOID FISH EMBRYOS.

By JOHN A. RYDER.

The species collected should be carefully identified, if the adults are not sent along with the embryonic material. Locality, etc., are also essential, together with dates of collecting.

If the gravid ovaries are removed it should be very carefully done, so as not to bruise, crush, or displace the contents. The gravid ovaries should then be placed in from ten to twenty times their own bulk of Muller's fluid, where they can remain for three or four weeks, but should not be so crowded into the phials as to be malformed. On the whole it would be preferable to get as small a species as possible and preserve the gravid adults entire in Muller's fluid, the body-cavity being first opened carefully to allow the fluid access to the interior. In this they may remain three or four weeks before removal into two or three changes of water during a day, when they may be put into 70 per cent. alcohol. Washing or soaking in water is desirable for a day to get rid of the salts in the fishes which discolor the alcohol and also, in combination with the latter, make the objects brittle.

It is very desirable that the embryos be in their normal positions and relations to the adult in the ovaries, and that as many stages as possible be obtained in order that my studies may be as consecutive as possible.

The Muller's fluid will be supplied in packages of 1⅓, 13, 1Ɔ, or what is enough of the powdered potash-bichromate, and sodic sulphate to make a quart of fluid with that amount of clean, fresh water. The material collected should be addressed to John A. Ryder, Smithsonian Institution, Washington, D. C.

Glass jars will be the best to keep the material in. Fruit jars with screw tops answer the purpose well and prevent the leakage of the yellow Muller's fluid.

Vol. V, No. 3. Washington, D. C. Jan. 19, 1885.

7.—NOTES UPON AN EXPLORATION ON LONG ISLAND SOUND.

By TARLETON H. BEAN.

[From a letter to Prof. S. F. Baird.*]

We have enjoyed a highly gratifying day of collecting, and our list of species now foots up 53. The Lookout has helped us to increase our store by the addition of 14 species since it came in. The weather so far has been propitious, and everybody seems satisfied. I am sorry that we did not secure the aid of the steamer much earlier, as we hoped to do. However, there are several accessions now of which I feel somewhat proud. We seined two examples of *Fistularia* to-day, besides a species of *Hemirhombus* (or *Platophrys*), and numerous examples of the ovate pompano, *Trachynotus ovatus*. *Bairdiella* is quite common; so, also, is *Synodus fœtens*. Two species of anchovy occur—one of them very abundant—in the eastern portion of the bay, and the other not moving so far from the ocean inlet; everywhere these little fishes attract the blue-fish, squeteague, silver gar, and other predaceous species. The silver sides (*Menidia notata*) are excessively abundant everywhere, and serve as food for blue-fish. I have been somewhat astonished to find one of the hakes (*Phycis tenuis*) well distributed in the bay, associated with the tomcod. The tomcod is much infested, in some places, with a lernæan parasite. *Gobiosoma* is very common. The tautog we find in greater numbers as we approach the inlet, and the same is true of the cunner. Young weak-fish (squeteague) are universal except in shoal water. Kingfish (*Menticirrus nebulosus*) are sufficiently numerous wherever we seine, but the young, from an inch and a half to two inches and a half or more in length, were taken in the surf to-day in larger numbers than I have seen before. The scup and the squeteague form the principal catch of the 7 pounds near the Fire Island light. Young sea bass are much more abundant at Wood's Holl than we find them here. The white perch, a comparatively recent arrival in Great South Bay, is becoming gradually distributed, but we have not yet caught a single example in our seines. *Synodus fœtens* is a very common species here, reaching all parts of the bay visited by our nets. We do not find young menhaden, and the only clupeoids secured are an occasional half-grown menhaden, one hickory shad (*Clupea mediocris*), and one alewife (*C. vernalis*, probably). The big-eyed eel is one of our treasures.

PATCHOGUE, N. Y., *September* 30, 1884.

*More detailed and systematic accounts will probably appear in Proc. Nat. Mus., 1885.

8.—THE HABITS AND THE VALUE FOR FOOD OF THE AMERICAN CHANNEL CAT-FISH (ICTALURUS PUNCTATUS, RAFINESQUE).

By DAVID S. JORDAN.

The channel cat reaches a length of 2 to 3 feet and a weight of 15 to 20 pounds or more. As usually seen in the markets it ranges from 1 to 5 pounds in weight, and those exceeding 5 pounds are not common.

It is handsomer, more graceful, and more active than any other of our catfishes. It is light olivaceous and silvery in color, covered with small brown spots when young. The skin is thin and translucent, much less thick and leathery than in our common catfishes (*Amiurus*). The head is small, the mouth small, and the body slender. There is much less waste in the body of the channel cat than in other catfishes, as the latter lose more than half their weight by the removal of the head, the entrails, and the skin.

The flesh of the channel cat, when fresh, is very superior; it is white, crisp, and juicy, of excellent flavor, and not tough. It is much more delicate both in fiber and in flavor than that of our other catfishes. When well cooked, I consider it superior to that of the black bass, the wall eye, the yellow perch, or any other of our percoid fishes. Among our fresh-water fishes, it is inferior only to the whitefish, the trout, and other *Salmonidæ*.

The channel cat abounds in all flowing streams from Western New York westward to Montana and southward to Florida and Texas. It is, perhaps, most common in Tennessee, Arkansas, and Missouri. It seems to prefer running waters, and both young and old are most abundant in gravelly shoals and ripples. The other catfishes prefer rather sluggish waters and mud bottoms. I have occasionally taken channel cats in ponds and bayous, but such localities are apparently not their preference. They rarely enter small brooks, unless these are clear and gravelly. Whether they will thrive in artificial ponds we can only know from experiment.

The channel cat is much less tenacious of life than the "bull-head" (*Amiurus nebulosus*) and other *Amiuri*. It is a carnivorous fish, although less greedy than its larger-mouthed relatives. It feeds on insects, cray-fishes, worms, and small fishes, and readily takes the hook. It spawns in spring, but its breeding habits have not been studied.

As a food fish, the channel cat is certainly better worthy of attention than any other American catfish. If once introduced, it ought to thrive in the rivers of the Middle States, of Southern New England, and of California. It is also to be commended to the attention of European fish-culturists. In the streams of Western Europe, which are not cold enough for clear enough for the trout, the channel cat ought to thrive, and there is no fish native to those waters which is as valuable for food.

INDIANA UNIVERSITY, BLOOMINGTON, IND., *December* 18, 1884.

9.—PROSPECTUS OF STRIPED BASS OPERATIONS FOR THE SEASON OF 1885.

By S. G. WORTH.

[From a letter to Prof. S. F. Baird.]

To conduct a season of entirely successful work at Weldon, N. C., in propagating striped bass, the following list of employés would be required: A captain in charge of force who is conversant with the general methods in detail, two hatchery experts, and an ordinary person to help them, and, in addition, four good spawn-takers, who should attend daily the fishing canoes and slides on the falls immediately at Weldon. The hatchery should be located at the mill premises of Maj. T. L. Emry, of Weldon, where there is plenty of water, and fall to the amount of 15 feet, available above hatching tables. Although the water is furnished by a canal making out of the Roanoke River 8 miles above, it does not settle well, and at times is liable to be very muddy; and yet such a small relative amount is required that the necessary filtration can be easily accomplished.

If there is an insufficiency of hydrostatic pressure precluding the application of the new filter with which experiments are being made at the Armory, I believe that no serious difficulty will be encountered from excessive mud if the method used by me last spring is adopted. As the results were satisfactory, I think it is well to mention the manner of extracting the bulk of mud. The method was extremely simple. I had wooden frames made of inch-square stuff, which, finished, were 30 inches square, to the number of about two dozen. On a third of these frames I tacked coarse horse blanketing, and on the remaining number I nailed equally common domestic cloth and canton flannel, and taking half of each kind placed them one upon the other, the coarser ones above, and turned the supply stream of water immediately upon the uppermost one. While the process did not clear the water by any means, it answered well; but at the same time it is highly desirable to have clearer water. The hatchery used last spring has only about 7 feet of available fall, and unless the automatic filter is required (which for any work done there next year I would not consider necessary) there is no apparent need of building any other hatchery. I am confident that it fills all immediate requirements, and that the board of agriculture would cheerfully enter into any arrangement with the United States Fish Commission to further its purposes there. Of course, a larger establishment might be required after better fishing and greater experience in collecting ripe fishes have been secured.

At Weldon the McDonald automatic jars were used in hatching the eggs, and, as stated in my report, to secure good results it is only nec-

essary to cut down the water, reducing the supply to each jar to about one quart each period of three minutes.

In doing work at Weldon, the difficulties attending the development of the eggs being removed, there remain two important points which should be carefully borne in mind, the one being the actual collection of the ripe fishes, and the other, the successful collecting and retaining of the fry. Of course, in using the word "collecting" a second time in the sentence above, it is readily understood that I have reference to the transfer of the embryo fishes from the jars to collectors in the form of aquaria. To collect the ripe fishes requires diligent labor on the part of the party in charge, which I could make very clear in a more lengthy communication.

If the United States Fish Commission should institute measures for conducting work at Weldon next year, I am confident, after mature reflection, that it would be wise to offer a premium to the fishermen for ripe fishes to the amount of $2 each on delivery. I have good reasons for saying this. In ordinary seasons not more than fifty ripe fish could be expected, and these could be delivered only at expense to the fishermen, owing to the character of the Weldon fishing, where paddling through swift currents for miles is required on each drift.

As to collecting the embryo fishes the best effort will be required; for the available water at Weldon, even after the most successful filtration, will contain sediment which will quickly obstruct any screen of sufficient fineness to hold the fry. The fry are very small, and in muddy water are extremely difficult to retain. I must frankly confess that I do not know what method of retaining them is really best.

Ordinarily, indeed each year, April 15 and May 15 may be considered the correct opening and closing days of work there; and I consider the short time in which work may be done worthy of special consideration, if it is contemplated to establish an extensive hatchery there and in time for next spring's work.

RALEIGH, N. C., *August* 30, 1884.

10.—HOW TO DISTINGUISH THE SEX OF CARP.

By CHAS. W. SMILEY.

When the adult fish is nearing the spawning time the ripening of the ova produces a broadened appearance in the female, which is sufficient to enable most any one to distinguish the sex. It is necessary, however, to be able to distinguish them at a much earlier age, and this, although not generally understood, is declared by experienced fish-culturists to present but little difficulty. Dr. Hessel, superintendent of the United States Government ponds, scarcely ever fails to identify the sexes, although he declares his inability to describe in words the man-

ner in which he does it. The German carp-culturists, however, have distinctly stated their method.

Horák, in a work published 1869, and entitled *Die Teichwirthschaft mit besonderer Rücksicht auf das südliche Böhmen. Ein populäres Handbuch für Teichwirthe, Fischereibedienste und Freunde der Fischzucht*, by Wenzel Horák, says: "Fishermen who are not able to determine the sexes of the fish at once are in the habit of squeezing the genital parts until they yield either milt or roe. This method is very injurious to the production of young fish. An experienced pond-culturist will, at the first glance, distinguish a male from a female carp, even when they are only one year old. The milter, or male fish, has a depression or concave place in its genital parts, while the spawner, or female fish, has a protuberance or convex place."

Carl Nicklas, perhaps the most skilled carp-culturist at present living in Germany, indorses the above quotation from Horák, and adds: "The aperture of the genital orifice also seems to be somewhat larger and redder in the female than in the male. It is not very difficult to distinguish the male from the female carp; still, it may require a little practice." Prof. B. Benecke, of Königsberg, says: "As a general rule the belly of the spawner is broader and rounder; the genital aperture is larger and reddish and has thick lips, while in the male it forms a narrow slit."

Apparently without any knowledge of these German authorities, George M. Ramsey, M. D., of Clokey, Pa., writing under date of November 22, 1883, says: "I have discovered how to distinguish the sex of German carp at all seasons of the year. By inspection of the female carp a small fleshy protuberance, that pouts a very little, will be seen in front of the vent, whereas in the male carp the same is slightly depressed or sunken rather than protuberant. On examination each fish should be held up to the light in the same position, back downward." Evidently Dr. Ramsey has made an independent discovery of what was already known in Germany.

Among the most successful of the Americans who have received carp from the United States Fish Commission is Mr. Kemp Gaines, of Springfield, Clarke County, Ohio. He had young fish to sell as early as the summer of 1883, and, seeing the necessity of furnishing applicants with the proper number of males and females, he undertook to see if he could discover any method of distinguishing sexes. November 21, 1883, he reported his observations to the Fish Commission. On examining the carp taken for table use he found a difference in the form of the head and surmised that this might possibly indicate the sex. He put it to test during the summer whenever he dressed fish for use and failed to distinguish the sex but once.

It would be gratifying if those who have carp would put these methods severely to test and report to the Fish Commission their success or failure.

UNITED STATES FISH COMMISSION,

Washington, D. C., November 18, 1884.

11.—HOW TO STRENGTHEN THE DUNES.*

By G. BOECK.

In an article on the formation of the dunes, in No. 33 of the *Deutsche Fischerei-Zeitung*, the author says in conclusion that, in his opinion—which is shared by many others—"Human power and human art can do nothing or but little to resist the force of the shifting dune." This often-repeated assertion is correct only in so far as it is impossible for human strength to stop a dune *while in the process of shifting its position*, but otherwise it is incorrect, and only serves as an excuse for the crude methods and small experience of the owners of dunes. It is contradicted by the actual facts. Most of the dunes on our coasts, *e. g.*, on the coast of Pomerania, from Kammin to Kolberg, and on the islands of Usedom and Wollin, *were*—as recorded in documents of undoubted authenticity—densely wooded centuries ago, oaks forming the predominant tree (many doorsteps, beams, joists, and stairways of old houses in those regions amply testifying to this fact). But even at the present day there are found in different parts of the dunes along our Baltic coast very compact woods entirely secured against being buried in the sand of the dunes. Such woods are found near Eiersberg, near the new mouth of the Rega, on the islands of Usedom and Wollin, &c.

If any one were to maintain that these woods had been created and sustained by nature, without the aid of human ingenuity and human skill, (this seems, at first sight all the more probable, as, owing to the fact that at present man seems to be powerless when brought face to face with the sand of the dunes), people are too ready to suppose that the magnificent woods which centuries ago clothed our dunes had only been the work of nature. Unfortunately we possess no data to aid us in answering the question whether our ancestors, nature's children, understood, better than we, their civilized descendants, how to plant the dunes with trees. In view of the unchangeable character of the open dunes, we may be justified to suppose that such planting was done in former times, especially as the experience of modern times speaks in favor of this supposition.

In the official reports on the condition of the forests in Pomerania it is stated that at least till within the past twelve years all the efforts made by the Government to strengthen the loose dunes belonging to the state, and again to clothe them with forests, have proved futile, while similar efforts made by private individuals were crowned with success, as is seen in the Eiersberg forest, east of the mouth of the Liebelose, and several other forests on the islands of Usedom and Wollin.

* "*Ueber Dünenbefestigung*," in *Deutsche Fischerei-Zeitung*, Vol. VII, No. 35, Stettin, August 26, 1884. Translated from the German by HERMAN JACOBSON.

In the documents referred to above it is also stated that on the coast of Pomerania, no matter whether it is sandy or clayey, land is constantly being washed away wherever the coasts is not wooded, but that where the coast is protected by a dense forest the sea gradually but undoubtedly deposits soil along the shore.

From the first statement it appears that the theoretical way of fighting the dunes is not correct on general principles. Without making any positive assertion, we must say that many circumstances justify the supposition that the failure of the Government efforts to strengthen the dunes has mainly been caused by the fact that an attempt was made in the very heart of the shifting dunes to fight nature's omnipotence, instead of attacking them at their starting point, from the direction from which the wind principally comes, *i. e.*, from the west, with gradually advancing plantations of trees. Another mistake made by the Government has been to use too few of the highly effective dwarf trees and shrubs.

Only by thus sheltering the dunes against the strongest wind, and by beginning at their outer spurs, they can be strengthened and again clothed with forests. Thus the Eiersberg forest, which at least twelve years ago was in an excellent condition, seems to have been started west of the dunes on the eastern shore of the river Liebelose, whose fertile water has, by producing reeds, alders, and other low trees, made it possible for the beautiful Eiersberg pine forest to grow and flourish.

The fact stated in the documents already referred to, that the sea has deposited soil along the densely-wooded dunes near Eiersberg, near the new mouth of the Rega, &c., is caused by the circumstance that the strength of storms or violent winds from the northwest, the north, and northeast, is broken and weakened by the thick protecting mantle of trees, even before reaching the shore, and that consequently the waves do not rush against the shore with such violence as would otherwise be the case, and, therefore, do not tear or wash anything away, but, on the contrary, deposit sand and mud which has been brought up from the bottom of the sea. Even a very cursory examination of these coasts and its unusually broad strand will prove this fact. According to the official reports, on the bare shores of Pomerania the breadth of *one foot* is annually washed away where the soil is firm and clayey, *e. g.*, near the Horst light-house, and a great deal more where the shore is composed of loose sand dunes; and thus Pomerania or Prussia *is gradually disappearing*, although the Government has it in its power not only to competely prevent this washing away of the shores, but even *to conquer back from the sea* the land which it has robbed in the course of hundreds and thousands of years, by planting trees on all bare coasts, especially as a lateral protection of the sand dunes proper, on the clayey or marshy shores in front of the dunes. Such plantations will in a peaceful manner extend our territory, and will do so still more as they increase in size.

Would that our Government might be induced to fight the encroaching sea in the manner indicated, and regain the hundreds of villages, farms, and towns on the coasts of Pomerania and Prussia, which have, in the course of centuries, been buried in the sand or been washed away by the waves. We possess ample guarantees in the facts stated above that such a thing is possible.

12.—NOTES ON THE ENGLISH HERRING AND MACKEREL FISHERIES, AND THE METHODS OF CURING.

By Capt. J. W. COLLINS.

[From a letter to Prof. S. F. Baird.]

The following notes on the English herring and mackerel fisheries, which I extract from a letter by Mr. Edward Jex, of London, and dated November 19, 1884, may prove of interest to you. I wish particularly to call your attention to the fact that in England they are preparing *kippered mackerel* as well as kippered herring. The latter are a most delicious article of food, and I assume that mackerel would be still better. It seems to me that in seasons when small mackerel are abundant and cheap, as, for instance, they have been the past summer, a large and profitable business might be done by putting them on the market cured as kippers. And there also would appear to be great possibilities in introducing in our markets the kippered herring, which, I believe, would meet with a great demand and remunerative prices as soon as its value was properly understood.

Mr. Jex is the owner of a fleet of smacks sailing from Yarmouth, and is a fish salesman at Billingsgate, where he has an opportunity for seeing the various phases of the trade. He writes:

"Since I wrote last the catches of herring have been very large at Great Yarmouth. Some of the boats, for the season, have taken over 100 last, 'long tale,' 10,000, 152 fish to count as 100 fish, consequently a last signifies 13,200 fish, long tale, as sold by the catcher. The take at Yarmouth alone, up to date of last Friday, November 14, was 20,613 lasts, 7,000 fish, and the prices they have sold at average from £5 to £10 per last. Our curers are very busy at this time in drying their herring, and others are preparing them in their own brine, in barrels, for exportation, particularly the high dried smoked ones, for the Spanish and Italian markets. And I have no doubt [that] your salted mackerel, also your dried cod, would sell well in those Catholic countries, also in South America. * * * The catches of herring have been equally as large at Lowestoft as at Yarmouth, and the take of mackerel this autumn has been very large. But all have been sold fresh, or split and smoked—what they call kippered here. There is a great demand for them when they are full of fat and done this way."

WASHINGTON, D. C., *December* 2, 1884.

13.—CHRONOLOGICAL LIST OF PAMPHLET PUBLICATIONS OF THE U. S. FISH COMMISSION FROM ITS ORGANIZATION IN 1871 TO JANUARY, 1885.

By CHAS. W. SMILEY and CHAS. W. SCUDDER.

1872.

1. *†[36] BAIRD, SPENCER F. Memoranda of inquiry relative to the food-fishes of the United States.

   [From Report for 1871–'72, pp. 1–3; also by Smithsonian Institution No. 231, in Misc. Coll. X.]

2. *[37] BAIRD, SPENCER F. Questions relative to the food-fishes of the United States.

   [From Report for 1871–'72, pp. 3–6; also by Smithsonian Institution No. 234, in Misc. Coll. X.]

1873.

3. *[35] BAIRD, SPENCER F. Report on the condition of the sea fisheries of the south coast of New England in 1871 and 1872.

   [From Report for 1871–'72, pp. i–xli.]

1874.

4. [48] BAIRD, SPENCER F. Report of the Commissioner for 1872 and 1873. A.—Inquiry into the decrease of food-fishes. B.—The propagation of food-fishes in the waters of the United States.

   [From Report for 1872–'73, pp. i–xcii.]

5. *[880] SMITH, SIDNEY I. The crustacea of the fresh waters of the United States.

   [From Report for 1872–'73, pp. 637–665, pl. 3.]

6. *[881] SMITH, SIDNEY I. Sketch of the invertebrate fauna of Lake Superior.

   [From Report for 1872–'73, pp. 690–707.]

7. *[882] SMITH, SIDNEY I. Food of fresh-water fishes.

   [From Report for 1872–'73, pp. 708, 709.]

8. *[968] VERRILL, A. E. Synopsis of the North American fresh-water leeches.

   [From Report for 1872–'73, pp. 666–689.]

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*This and all other items marked with the asterisk are out of print, and copies cannot be furnished.

†Figures in brackets denote the numbers of the papers in the "List of papers relating to the work of the U. S. Fish Commission," &c., by Charles W. Smiley, in Bulletin of the Commission. Vol. III, 1883, pp. 1–84.

1875.

9. *[283] GILL, THEODORE. Natural and economical history of the gourami.

[From Report for 1872–'73, pp. 710–728, pl. 2.]

1876.

10. [52] BAIRD, SPENCER F. Questions relative to the cod and cod fisheries. Pp. 4.

11. [53] BAIRD, SPENCER F. Questions relative to the mackerel and mackerel fisheries. Pp. 4.

12. [54] BAIRD, SPENCER F. Questions relative to the alewife and alewife fisheries. Pp. 4.

13. [56] BAIRD, SPENCER F. Questions relative to the smelt and the smelt fisheries. Pp. 4.

14. [248] FARLOW, W. G. List of marine algæ of the United States.

[From Report for 1873–'74 and 1874–'75, pp. 691–717.]

15. [57] BAIRD, SPENCER F. Report of the Commissioner for 1873–'74 and 1874–'75. A.—Inquiry into the decrease of food-fishes. B.—The propagation of food-fishes in the waters of the United States.

[From Report for 1873–'74 and 1874–'75, pp. vii–xlvi.]

1877.

16. *[625] KIDDER, J. H. Hints for emergencies. Prepared for the use of field parties of the U. S. Fish Commission. Pp. 7.

1878.

17. [60] BAIRD, SPENCER F. Report of the Commissioner for 1875–1876. A.—Inquiry into the decrease of food-fishes. B.—The propagation of food-fishes in the waters of the United States.

[From Report for 1875–'76, pp. 1*–50.*]

1879.

18. *[64] BAIRD, SPENCER F. Statistics of menhaden fisheries, &c. Circular and questions.

[From Report for 1877, pp. 268–271.]

19. †GOODE, G. BROWN and TARLTON H. BEAN. List of the fishes of Essex County, including those of Massachusetts Bay, according to the latest results of the work of the United States Fish Commission.

[From the Bulletin of the Essex Institute, vol. xi, 8°, pp. 38.]

†Not published by the United States Fish Commission, but copies for distribution are on hand.

20. [55] BAIRD, SPENCER F. Statistics of coast and river fisheries Pp. 4.

21. [21] ATKINS, CHARLES G. Cheap fixtures for the hatching of salmon.

[From Report for 1878, pp. 944–965.]

22. [80] BAIRD, SPENCER F., FRANCIS A. WALKER, and G. BROWN GOODE. Returns of circular relating to fish trade and consumption of fish.

[Published by census, No. 7–0 ½2, 2 eds., pp. 3.]

23. *[334] GOODE, G. BROWN. Plan of inquiry into the history and present condition of the fisheries of the United States.

[From Report for 1880, pp. 3–52.]

24. [190] COPELAND, CHARLES W. Specifications for building the screw-steamer Fish-Hawk for the United States Commission of Fish and Fisheries.

[By the United States Light-House Establishment, pp. 46.]

25. [63] BAIRD, SPENCER F. Report of the Commissioner for 1877. A.—Inquiry into the decrease of food-fishes. B.—The propagation of food-fishes in the waters of the United States.

[From Report for 1877, pp. 1*–48*.]

26. *[275] GAMGEE, JOHN. On artificial refrigeration.

[From Report for 1877, pp. 901–972, pl. 3, figs. 5]

1880.

27. [410] HESSEL, RUDOLPH. The carp and its culture in rivers and lakes, and its introduction into America.

[From Report for 1875–'76, pp. 865–900, figs. 6.]

28. [65] BAIRD, SPENCER F. Report of the Commissioner for 1878. A.—Inquiry into the decrease of food-fishes. B.—The Propagation of food-fishes in the waters of the United States.

[From Report for 1878, pp. xv–lxiv.]

1881.

29. *[70] BAIRD, SPENCER F. Circular in reference to shipping fresh fish and other animals.

[Published by the Smithsonian Institution, pp. 4.]

30. [116] BEAN, TARLETON H. Directions for collecting and preserving fish.

[Published by the Smithsonian Institution, pp. 6.]

31. [360] GOODE, G. BROWN and J. W. COLLINS. The winter haddock fishery of New England.

[From Bulletin for 1881, pp. 226–235.]

32. [387] HARGER, OSCAR. Report on the marine Isopoda of New England and adjacent waters.

[From Report for 1878, pp. 297–462, pl. 13, index.]

33. *[230] EARLL, R. EDWARD. A report on the history and present condition of the shore cod fisheries of Cape Ann, Massachusetts, together with notes on the natural history and artificial propagation of the species.

[From Report for 1878, pp. 685–740, pl. 3, index.]

34. [1005] WILSON, EDMUND B. Report on the *Pycnogonida* of New England and adjacent waters.

[From Report for 1878, pp. 463–506, pl. 7, index.]

35. BAIRD, GEORGE W. Specifications for the paddle-wheel steam seine boat Canvas-back, for service in the bay and river fisheries. Pp. 12.

36. *[251] FARLOW, W. G. The marine algæ of New England.

[From Report for 1879, pp. 1–210, pl. 15, index.]

37. [174] COLLINS, J. W. Gill nets in the cod-fishery; a description of the Norwegian cod-nets, with directions for their use, and a history of their introduction into the United States.

[From Bulletin for 1881, pp. 1–17.]

38. [191] COPELAND, CHARLES W. Specifications for building the screw-steamer Albatross for the United States Commission of Fish and Fisheries.

[By the United States Light-house Establishment, pp. 51.]

1882.

39. *[71] BAIRD, SPENCER F. Directory of the officers, collaborators, employés, &c., of the Smithsonian Institution, National Museum, Geological Survey, and Fish Commission.

[Published by the Smithsonian Institution, 8°, No. 3961, pp. 8.]

40. *[482] JACOBSON, H. Translator. Popular extracts from the investigations of the commission for the scientific examination of the German seas. Published by the royal ministry of agriculture, domains, and forests. [H. A. Meyer, K. Möbius, G. Karsten, and V. Hensen.]

[From Report for 1879, pp. 525–557.]

41. [879] SMITH, SANDERSON, and RICHARD RATHBUN. Lists of the dredging stations of the United States Fish Commission from 1871 to 1879, inclusive, with temperature and other observations.

[From Report for 1879, pp. 559–601.]

42. [972] VERRILL, A. E. Report on the cephalopods of the northeastern coast of America.

[From Report for 1879, pp. 211–455, pl. 46, index.]

43. [850] SCUDDER, NEWTON P. The halibut fishery, Davis' Strait.
[From Report for 1880, pp. 189–228, index.]

44. [76] BAIRD, SPENCER F. Memoranda for the construction of a harbor of refuge at Wood's Holl, Mass.
[In circular form, type-written and lithographed, 4°., pp. 6.]

45. *[231] EARLL, R. EDWARD. Statistics of the fisheries of Maine.
[Census Bulletin No. 278, p. 47.]

46. [72] BAIRD, SPENCER F. Report of the Commissioner for 1879. A.—Inquiry into the decrease of food-fishes. B.—The propagation of food-fishes in the waters of the United States.
[From Report for 1879, pp. xi–li.]

47. *[1019] WRIGHT, HARRISON, chairman of the committee. Report of a committee of the Wyoming Historical and Geological Society on the early shad fisheries of the north branch of the Susquehanna River.
[From Bulletin for 1881, pp. 352–359.]

48. *[588] JORDAN, DAVID S., and CHARLES H. GILBERT. Descriptions of nineteen new species of fishes from the Bay of Panama.
[From Bulletin for 1881, pp. 306–335.]

49. [74] BAIRD, SPENCER F. Laws and regulations of the United States Fish Commission, pp. 32.

50. [75] BAIRD, SPENCER F. Classification of exhibits at London Fishery Exhibition, pp. 3.

1883.

51. [336] GOODE, G. BROWN. Materials for a history of the swordfishes.
[From Report for 1880, pp. 287–392, pl. 24, index.]

52. [1067] GOODE, G. BROWN, JOSEPH W. COLLINS, R. E. EARLL, and A. HOWARD CLARK. Materials for a history of the mackerel fishery.

53. *[77] BAIRD, SPENCER F. Inducements offered fishermen to furnish shad eggs for the United States Commission of Fish and Fisheries.
[From Bulletin for 1882, pp. 389–391.]

54. BAIRD, SPENCER F. Preliminary catalogue and synopsis of the collections exhibited by the United States Fish Commission and by special exhibitors, with a concordance to the official classification of the exhibition.
[London Exhibition, part A, pp. 107.]

55. RATHBUN, RICHARD. Collection of economic crustaceans, worms, echinoderms, and sponges.
[London Exhibition, part B, pp. 31.]

56. RIDGWAY, ROBERT. Catalogue of the aquatic and fish eating birds, exhibited by the United States National Museum.

[London Exhibition, part C, pp. 46.]

57. WINSLOW, FRANCIS. Catalogue of the economic mollusca and the apparatus and appliances used in their capture and preparation for market. Exhibited by the United States National Museum.

[London Exhibition, part D, pp. 86.]

58. BROWN, JAMES TEMPLE. The whale fishery and its appliances.

[London Exhibition, part E, pp. 116.]

59. BEAN, TARLETON H. Catalogue of the collections of fishes exhibited by the United States National Museum.

[London Exhibition, part F, pp. 124.]

60. [232] EARLL, R. EDWARD. The Spanish mackerel, *Cybium maculatum* (Mitch.) Ag.; its natural history and artificial propagation, with an account of the origin and development of the fishery.

[From Report for 1880, pp. 395–426.]

61. *McDONALD, MARSHALL. Specifications for the superstructure of the fish-way proposed for the Great Falls, Potomac River, Maryland, pp. 3.

62. [78] BAIRD, SPENCER F. Report of the Commissioner for 1880. A.—Inquiry into the decrease of food-fishes. B.—The propagation of food-fishes in the waters of the United States.

[From Report for 1880, pp. xvii–xlvi.]

63. *[789] POTTS, EDWARD. Fresh-water sponges. What, where, when, and who wants them.

[From Bulletin for 1883, pp. 389–391.]

64. SMILEY, CHARLES W. Carp and carp ponds: (1) Answer to 118 questions relative to German carp; (2) Directions concerning the construction of carp ponds.

[From Bulletin for 1883, pp. 241–256.]

1884.

65. BAIRD, SPENCER F. Report of the Commissioner for 1881. A.—Inquiry into the decrease of food-fishes. B.—The propagation of food-fishes in the waters of the United States.

[From Report for 1881, pp. xiii–lxxi.]

66. SMILEY, CHARLES W. Special Bulletin: (1) Notes on the edible qualities of German carp and hints about cooking them; (2) The German carp and its introduction in the United States.

[From Bulletin for 1883, pp. 305–336.]

67. RYDER, JOHN A. Rearing oysters from artificially fertilized eggs, together with notes on pond-culture, &c.

[From Bulletin for 1883, pp. 281–294.]

68. WEBSTER, H. E. and JAMES E. BENEDICT. The *Annelida chætopoda* from Provincetown and Wellfleet, Massachusetts.

[From Report for 1881, pp. 699–747.]

69. RATHBUN, RICHARD. Descriptive catalogue of the collection illustrating the scientific investigation of the sea and fresh waters.

[London Exhibition, part G, pp. 109.]

70. TANNER, Z. L. Report on the construction and work in 1880 of the Fish Commission steamer Fish Hawk.

[From Report for 1881, pp. 3–53.]

71. RYDER, JOHN A. A contribution to the embryography of osseous fishes, with special reference to the development of the Cod (*Gadus Morrhua*).

[From Report for 1882, pp. 455–605.]

72. MCDONALD, MARSHALL. Report submitting plans and specifications of the fishways for the Great Falls of the Potomac River, pp. 1–22.

73. BAIRD, G. W. Annual report on the electric lighting of the United States steamer Albatross, December 31, 1883.

[From Bulletin for 1884, pp. 153–158.]

74. TRUE, FREDERICK W. Catalogue of the aquatic mammals exhibited by the United States National Museum.

[London Exhibition, Part H, pp. 22.]

75. GOODE, G. BROWN. The status of the United States Fish Commission in 1884. A review of what has been accomplished in fish-culture, and the investigation of the American fisheries.

[From Report for 1884, pp. 1–42.]

76. RYDER, JOHN A. On the preservation of embryonic materials and small organisms, together with hints upon embedding and mounting sections serially.

[From Report for 1882, pp. 607–629.]

77. BAIRD, SPENCER F. Report of the Commissioner for 1882. A.—Inquiry into the decrease of food-fishes. B.—The propagation of food-fishes in the waters of the United States.

[From Report for 1882, pp. xvii, xcii.]

78. SMITH, SIDNEY I. Report on the decapod crustacea of the Albatross dredgings off the east coast of the United States in 1883.

[From Report for 1882, pp. 345–426.]

79. TANNER, Z. L. Report on the work of the U. S. Fish Commission steamer Fish Hawk, for the year ending December 31, 1882, and on the construction of the steamer Albatross.

[From Report for 1882, pp. 3–34.]

80. McDONALD, MARSHALL. A new system of fishway building.
[From Report for 1882, pp. 43–52.]

81. COLLINS, J. W. History of the tile-fish.
[From Report for 1882, pp. 237–294.]

82. COLLINS, J. W. Notes on the habits and methods of capture of various species of sea-birds that occur on the fishing banks of the eastern coast of North America, and which are used as bait for catching codfish by New England fishermen.
[From Report for 1882, pp. 311–338.]

83. VERRILL, A. E. Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England, and of some additions to the fauna of Vineyard Sound.
[From Report for 1882, pp. 641–669.]

84. VERRILL, A. E. Physical characters of the portion of the continental border beneath the Gulf Stream explored by the Fish Hawk, 1880 to 1882.
[From Report for 1882, pp. 1045–1057.]

85. SMILEY, CHARLES W. Report on the distribution of carp to July 1, 1881, from young reared in 1879 and 1880.
[From Report for 1882, pp. 943–988.]

86. BEAN, TARLETON H. List of the fishes distributed by the United States Fish Commission.
[From Report for 1882, pp. 1039–1044.]

87. BEAN, TARLETON H. List of fishes collected by the United States Fish Commission at Wood's Holl, Mass., during the summer of 1881.
[From Report for 1882, pp. 339–344.]

88. SMILEY, CHARLES W. The influence of artificial propagation upon production. Illustrated by the salmon work of the Sacramento River, California.
[From Bulletin for 1884, pp. 201, 202.]

89. TRUE, FREDERICK W. Suggestions to the keepers of the United States life-saving stations, light-houses, and light-ships, and to other observers, relative to the best means of collecting and preserving specimens of whales and porpoises.
[From Report for 1884, pp. 1–26.]

90. SHUFELDT, R. W. The Osteology of *Amia calva:* including certain special references to the skeleton of Teleosteans.
[From Report for 1883, pp. 1–132.]

Vol. V, No. 4. Washington, D. C. Jan. 19, 1885.

14.—NOTES ON THE COD GILL-NET FISHERIES OF GLOUCESTER, MASS., 1884-'85.

By S. J. MARTIN.

[From letters to Prof. S. F. Baird.]

The first cod gill-nets were set September 30, but no cod have yet been caught in them. Yesterday a boat with five nets caught 50 large pollock. Gill-net fishing will be carried on to a much greater extent this year than last.

GLOUCESTER, MASS., *October* 5, 1884.

The ten boats that are fishing with cod gill-nets catch mostly large pollock. These fish average 23½ pounds as they come from the water. I have seen a lot of 6,000 pounds landed, which averaged 24 pounds to the fish. One pollock was landed which weighed 37½ pounds. The average weight of pollock caught on hand lines is 13 pounds.

In seven days and with twenty-four nets, the schooner Dixie landed 135,000 pounds of pollock and 5,000 pounds of large cod. Her nets are 50 fathoms long and 2 fathoms deep. With sixteen nets of the same size, the schooner Hector took 26,000 pounds of pollock and 1,000 pounds of large cod last week.

This afternoon the whole ten vessels that are using nets were in with their decks full of large pollock and large codfish. They landed 140,000 pounds of pollock and 5,000 pounds of cod. Pollock sold to-day at 50 cents a 100 pounds. It is being dressed and gotten ready to ship to Boston, Monday morning. The large pollock make very nice steak, and are considered better for frying than cod.

The hand-liners all catch small fish, and they are quite angry toward the gill-netters. In some instances they have anchored on top of the gill-nets, injuring them. The people gather along the wharves to see the large pollock unloaded from gill-net vessels and the small pollock unloaded from hand-line vessels, and think it a great curiosity. There have been 3 puffers caught in the cod gill-nets.

GLOUCESTER, MASS., *October* 26, 1884.

The amount of fish caught in gill-nets and landed here during the past week is as follows: 915,000 pounds of pollock and 67,000 pounds of large cod.

Considering the number of boats, nets, and men engaged in fishing, the catch yesterday exceeds anything on record. Thirteen small vessels, fishing with cod gill-nets, landed last night and this morning 250,000 pounds of pollock and 20,000 pounds of large cod. These fish

were caught in seventy-six nets, 50 fathoms long and 2½ fathoms deep, and were fished by 95 men. Some of the boats left some of the nets, not being able to take all the fish that were in them. When the schooner Hector came to its nets, three of them were found on the top of the water, the buoyancy of the pollock being so great as to part the anchor lines and cause the nets to come to the surface. There were 8,000 pounds of fish taken out of three small nets, while one small boat with six nets landed 12,000 pounds.

The pollock-catchers who use hand lines have hauled up, not being able to catch any fish.

The twine now used in the manufacture of cod gill-nets is not fit to use in catching pollock; the nets should be made of salmon twine. A large fleet will use the cod gill-net this winter, and some vessels of 80 tons burden are getting ready to set them. Codfish have begun to come on the rocks. They are large, and are mostly females, a number of which are full of ripe spawn. The pollock are large, averaging 23½ pounds in weight, and are half male and half female. Pollock sold to-day at 40 cents, and codfish at $1.10 per 100 pounds.

GLOUCESTER, MASS., *November* 2, 1884.

The cod gill-net fishery is assuming large proportions. There are thirty-five vessels now engaged in it, eight of which are now in Ipswich Bay and the remainder off Half-way Rock, in Boston Bay. A vessel of seventy-five tons usually carries 40 nets. The cod are not very plenty. Last week vessels fishing with nets landed at Gloucester 97,000 pounds of cod and 322,000 pounds of pollock; at Rockport, 48,000 pounds of cod and 15,000 pounds of pollock; at Lynn, 70,000 pounds of cod and 32,000 pounds of pollock. Some of the fishermen with hand lines are catching large cod from the schools in Boston Bay, using squid for bait. Boats with two men catch 1,000 pounds per day.

GLOUCESTER, MASS., *November* 16, 1884.

All the vessels that were sent to the Grand Banks for cod are home and hauled up. There are a few still fishing on George's. There are fifty-two vessels now fishing with gill-nets, and they catch a large quantity of cod and pollock.

GLOUCESTER, MASS., *November* 19, 1884.

SUMMARY FOR NOVEMBER.—During the month there were caught in cod gill-nets 883,000 pounds of cod and 1,057,000 pounds of pollock. There were landed at Rockport 293,000 pounds of cod and 105,000 pounds of pollock. There were landed at Lynn 268,000 pounds of cod and 80,000 pounds of pollock. Codfish sold at 2½ cents a pound.

GLOUCESTER, MASS., *December* 2, 1884.

Vessels using the cod gill-nets have found fish scarce the past week. December 7th as high as 10,000 pounds were taken, while on the next day only 500 pounds were taken in the same gang of nets. Since last Monday, boats with twenty-five nets have been catching from 300

to 800 pounds each. The boats that went out to their nets this morning caught from 6,000 to 8,000 pounds each, while the night before the same nets in the same place only caught from 300 to 500 pounds.

GLOUCESTER, MASS., *December* 14, 1884.

15.—THE PENOBSCOT AND SCHOODIC SALMON WORK OF 1884-'85.

By CHAS. G. ATKINS.

[From a letter to Prof. S. F. Baird.]

The eggs taken this year at the Penobscot station will count nearly 1,900,000. This is about 600,000 less than last year, though we had a larger number of fish. The explanation is found in two circumstances: First, that the fish were much smaller than last year; second, that there was a larger proportion of males. I think we can count on having 1,750,000 eggs to ship. Your pro rata share will be about 1,050,000. Maine will have 500,000; Massachusetts 200,000. It would be well to have, at any rate, a partial assignment made very soon. We had warmer weather than usual in November, and the eggs are more forward in development. I think Mr. Mather would be glad to receive some early.

At Grand Lake stream we secured about 1,727,000 eggs. A loss of 10 per cent. will leave 1,554,000, and the 25 per cent. reserve (388,500) will reduce the number available for shipment to 1,165,500. A pro rata division, on the basis of 1,150,000, will give to—

United States ($\frac{13}{25}$)	598,000
Maine ($\frac{5}{25}$)	230,000
Massachusetts ($\frac{4}{25}$)	184,000
New Hampshire ($\frac{3}{25}$)	138,000
	1,150,000

These eggs are now in our coldest water, and will not be ready for shipment before late in February. I would like to find whether the serious losses that have attended shipments to the South and West cannot be avoided by keeping the eggs in lake water during the entire time of their development at Grand Lake stream, instead of exposing them for a few weeks to spring water as we have heretofore practiced, with a view to hastening their development.

The fish at Grand Lake stream have been plentier than last year, and the augmentation in size continues. The females taken this year averaged 3 pounds and 15.7 ounces in weight, the males 4 pounds and .1 ounce. In 1875, the males averaged 1.6 pounds, and the females 1.9 pounds. There has been a corresponding appreciation in fecundity, the yield being 753 eggs per female in 1875, and 2,228 eggs per female in 1884, a gain of nearly 200 per cent.

BUCKSPORT, ME., *December* 12, 1884.

16.—REPORT OF THE WORK IN AN OYSTER INVESTIGATION WITH THE STEAMER LOOKOUT.

By EUGENE G. BLACKFORD.

I have the honor to submit the following report of the work in the oyster investigation with the steamer Lookout, which you so kindly placed at the disposal of the New York State Oyster Investigation Commission:

During the thirteen days from September 12 to September 24, inclusive, that the steamer Lookout was at my disposal for the purpose of rendering assistance in our State oyster investigation ten trips were made with her to various points in the immediate vicinity of the city of New York, and along the north shore of Long Island as far east as Northport Harbor. The trips, which were very satisfactory in their general results, were made in the following order: City Island, Perth Amboy and the south end of Staten Island, Cold Spring Harbor, Hempstead Harbor, Little Neck Bay, Manhasset or Cow Bay, Execution Lighthouse Rock, Port Chester and Rye Beach, Northport Harbor, Princess Bay, and Spuyten Duyvel Creek.

During each trip one or more dredgings were made upon both the planted and natural beds of the vicinity, and specimens of the oysters of the beds were selected and preserved from each haul of the dredge. Notes were made as to the general condition of the beds, as shown by the proportion of oysters and shells taken at the different hauls, and the presence or absence of the various enemies of the oyster; also all information, which could be gained in so short a time in regard to the general working of the beds and the industry in that particular locality.

September 13.—The first trip was made to City Island, which lies northeast of the city near the entrance into the sound. Capt. Joshua Leviness was taken on board as pilot. He owns about 150 acres of oyster territory near the island, and was the first person to set stakes for oyster-planting in the East River. Originally all the land under water about the island was natural oyster ground, but at present most of it has been taken up and staked off for "plants." Before the staking off took place much of the territory had become exhausted from overworking by the oystermen, and some of the land has been ruined by the dumping of garbage. The first dredge was made upon Captain Leviness' planted ground. The dredge was down one minute, and came up with 198 oysters and a few mussels, clams, and scallops. There were not many shells and only a few drills. The second dredging was made on a natural bed, and resulted in 16 small oysters and quite a number of shells. The planted oysters were of good size and fine flavor. There was no set of young oysters on either the planted or the native

oysters, but the captain stated that the set was generally good. The water is from 2 to 12 fathoms over the beds, and dredges are used in working the beds. The dredges on the north shore of the island are limited to 30 pounds in weight, and probably the greater number of them are without teeth on the drag-bar. In the shallow water along the shores and in the coves tongs are used in taking the oysters from the bottom. The principal enemies of the oyster in this locality are the drills, *Urosalpinx cinerea*, but now and then the beds are troubled with starfish. The seed for the planted ground is taken either from the native beds or brought from Connecticut.

September 15.—At Perth Amboy Mr. John Sofield was taken on as pilot, and the vessel was put to work among the planted beds to the south of Staten Island, in the mouth of Raritan Bay. The beds here, as indeed in all this neighborhood, in either New York or New Jersey waters, are very numerous and very small, in many cases hardly more than the size of the vessel. They are as a rule well cared for and furnish fine oysters. There were no natural beds in this neighborhood. The seed for the planted beds comes from Newark Bay and some from New Haven, Conn. The first and second dredges were made on the pilot's grounds and resulted in 33 and 74 oysters, respectively. The oysters were of good size, with very little refuse material. The third dredge was made upon the ground of Mr. William Sofield. The dredge was down two minutes and brought up 341 oysters. The oysters were in fine condition and very few drills were seen. The beds are well cared for and protected.

September 16.—Cold Spring Harbor. After visiting the State hatchery, located at the head of the harbor, where some experiments in the artificial hatching of oysters were being carried on, Mr. Charles Walters was taken aboard as pilot and dredges were made on his planted ground and on a strip of natural bed along the eastern side of the harbor. The wind was quite strong, and it was accordingly rather difficult to manipulate the vessel to the best advantage for either the natural or planted beds, hence the results were not as good as they ought to have been. The central part of the harbor and up quite close to the shores the bottom is of rather deep mud, so that most of the planted grounds are close to the shores, and the only strip of natural ground of any extent is along the east shore in about 8 feet of water and inside of the planted beds. The oysters on the planted beds grow quite rapidly and are of very fine flavor. The first dredge on the natural bed resulted in 17 oysters and a good many shells and some drills. The second dredge on the pilot's planted bed resulted in 26 oysters of good size and very few shells. There are a good many drills and whelks in the harbor, and some years the star-fish comes in great numbers, but not often. The seed is brought from the sound beds or from Connecticut. In some parts of the harbor the set this season is very fine.

September 17.—Hempstead Harbor. This harbor has much more hard

bottom and consequently more natural oyster beds than Cold Spring Harbor. There is also a good deal of planted ground, but so far as we could judge the planted ground was not of very much account and very poorly cared for. Mr. J. K. Mott and Mr. David Meissner were taken on board at Sea Cliff as pilots. The first four dredgings were made on natural beds, but the bottom was too hard for the dredges which we had on board, so that a very large haul was not made either time.

First dredge: Down five minutes; result, 32 oysters, 20 mussels, and a good many shells.

Second dredge: Down three minutes; result, 60 oysters, 8 mussels, many shells, 3 spider-crabs.

Third dredge: Down two minutes; result, 46 oysters, 33 mussels, many shells, 2 spiders.

Fourth dredge: Down three minutes; result, 29 oysters, 5 mussels, many shells.

In the last three dredges there were a few "set" seen and some drills.

Fifth dredge: Planted ground; down one and a half minutes; result, 2 oysters, any quantity of shells, and 3 star-fish.

Sixth dredge: planted ground; down three minutes; result 3 oysters, 21 star-fish and many shells. In both of these last dredges there were also a good many drills. The seed of the planted beds comes either from the sound or the harbor natural beds.

The oysters as a rule were of fair size and good flavor. The dredges used in the bay are mostly what are known as "scrapes," or without teeth, as the teeth slip over the oysters on hard bottom instead of picking them up.

September 18.—Little Neck Bay. This bay was found to be very shallow and muddy. No natural beds could be found, and there were only a few plots of planted ground along the eastern shore near Great Neck. The seed for these planted beds comes from the Sound beds. The oysters on these beds were of fair size and there was some "set." The growth of the oysters here, as indeed all along the north shore of the island, is quite fast. No dredgings were made.

September 19.—Manhasset, or Cow Bay. Mr. John Van Pelt, of Port Washington, Long Island, was taken on here as pilot, and under his direction four dredgings were made, one on planted and three on natural beds.

First dredge on planted ground resulted in bringing up 152 oysters, 144 mussels, 4 clams, and 1 sea-spider.

Second dredge: Natural bed, 32 oysters.

Third dredge: Natural bed, 26 oysters, 1 horseshoe crab.

Fourth dredge: Natural bed, 25 oysters.

The upper part of the bay is very much troubled with drills. No star-fish of any account have been seen in the bay this season. The difference in the number of oysters taken in this bay on the first and the subsequent dredges, as well as in Hempstead Bay, is accounted for

by the kind of dredges used. The dredges on board the Lookout were large and with good-sized teeth, well suited for work on mud bottoms such as are found mostly in connection with the planted beds, but for the natural beds a "scrape" is required in order to gather up many oysters.

The oysters in this bay were all very large and of exceedingly fine flavor, perhaps the finest yet tested.

September 20.—Execution Light-house Rock. This is a patch of natural oyster ground of several acres in extent, and located in water from 8 to 12 fathoms in depth. Four dredgings were made from the steamer, the first two bringing up full complements of oysters, and the second two bringing up mostly mud and shells. The oysters as a rule were large, but set very ragged, similar to the Raccoon oysters of the South, and of very poor flavor, being quite thin and watery.

Probably later in the season they would be of better flavor, as the oysters on this rock spawn later than on any other bed in this part of the sound.

First dredge: 253 oysters, shells, some set.

Second dredge: 87 oysters, shells, some set.

Third dredge: 35 oysters, mud, shells.

Fourth dredge: 23 oysters, mud, shells.

A few drills were noticed among these oysters.

September 22.—Port Chester and Rye Beach. In the immediate neighborhood of Port Chester and in New York waters only planted beds were found, and these did not appear to be very prolific, and such oysters as were taken were quite small.

First dredge: 5 oysters, shells, few drills.

Second dredge: 4 oysters, shells, few drills.

Along Rye Beach there was quite a strip of natural ground, but all the oysters were very small, as they are culled over constantly during the season for seed for the planted beds. The small oysters were quite numerous, however, although, on account of their size, no great number could be taken at any one haul. Most of the oysters were about the size of a silver quarter or a half dollar. They bring 75 cents a bushels as seed, and are sold to New York and Connecticut oystermen.

First dredge: 50 oysters, some shells, crabs.

Second dredge: 75 oysters, some shells, crabs.

Third dredge: 60 oysters, some shells, crabs.

The dredges used here are small scrapes of from 15 to 20 pounds in weight. A good many drills were found among these oysters. The crabs taken were small and of the stone-crab species.

September 23.—Northport Harbor. It was expected that a good deal of natural ground could be found in this harbor, but soon after we began work we were led to infer from the statement of Mr. William Thompson, who was taken on board as pilot, that there were no natural grounds, until the outer harbor was reached, and we did not learn

differently until it was too late to go to the natural grounds. Seven dredgings were made on planted bottom. The first three on land planted by Mr. Thompson and the last four on ground planted by Mr. S. H. Lowndes.

First dredge: 12 feet water, 39 oysters, 3 whelks, shells.
Second dredge: 12 feet water, 45 oysters, 3 sea spiders, shells.
Third dredge: 12 feet water, 40 oysters, shells.
Fourth dredge (oysters five years old): 461 oysters, 4 spiders.
Fifth dredge (oysters three years old): 180 oysters.
Sixth dredge (oysters three years old): 130 oysters.
Seventh dredge (oysters three years old).: 221 oysters.

On the oysters taken in the first haul a few "set" were found but not on the rest. Drills were found in considerable number. The harbor appears to be pretty well adapted to the growth of oysters, as most of those taken were large and of fine flavor. A good deal of the seed for the planted beds comes from Connecticut, although some is obtained from the Sound and from the natural beds of the harbor. These latter are found to occupy a goodly share of the bottom in the northeast part of the harbor. So far this season the star-fish have not been troublesome. A source of considerable controversy in the neighborhood of this harbor is the freedom with which outsiders can come into the harbor and stake out claims to the detriment of the native residents. It is claimed that a good many people from Connecticut come over to Northport, rent a house during the oyster season, work the natural and planted beds for all they are worth, and then live in Connecticut during the rest of the year. The people of Northport are very desirous that laws should be established to prevent this. It is indeed a very general complaint along the north side of the island that Connecticut oystermen can come into New York State waters and gather oysters, but that New York oystermen are deprived by the laws of Connecticut from returning the compliment. They consider this as unjust to the people of the State.

September 24.—Princess Bay. Most of the ground in the neighborhood of this bay was originally natural oyster ground, but it has now been mostly surrendered and staked out for purposes of planting, and it represents perhaps the largest area of staked claims anywhere in the neighborhood of New York.

The Lookout in steaming through the water in this region seemed as if literally going through a sea of stakes. Mr. Wesley Marshall was taken on board from his oystersmack, the Joseph Francis, as pilot, and four dredgings were made on the natural beds outside the staked limits, but the bottom was found to be very muddy, and in the first three dredgings only mud and shells were taken. In the fourth dredging two oysters were obtained, showing very clearly that the natural ground in these waters was of very little value except for clams, which are found quite plentifully in certain localities. The next two dredgings were made on Mr. Marshall's planted ground.

Fifth dredge (two minutes): 170 oysters, three years old; some shells.

Sixth dredge (two minutes: 445 oysters, two years old.

The planted beds in this bay are, as a rule, in good condition and not much troubled with enemies, although some drills are found and the drumfish now and then poaches among these preserves; whelks are also found to some extent. Flavor and condition of oysters good, although rather salt.

Spuyten Duyvel Creek. Years ago the Hudson furnished oysters for quite a distance from its mouth above present city limits, but not a great many are found at the present time. Four dredgings were made in about 4 fathoms of water. From two of the hauls 14 oysters were obtained and a good many shells. From the other two only shells were secured. The oysters were all quite small. These dredgings were made above the railroad bridge. A dredging in the mud south of the creek brought up a large number of small soft-shelled clams. The beds in this neighborhood present the appearance of being worked to their destruction.

Most of the natural beds examined during the trips made with the steamer show unmistakable signs of unscrupulous working and little care for the preservation of the beds. They are littered with rubbish of every kind, particularly with old and slimy shells, and appear in too many cases to be the general dumping ground for all sort of garbage from passing vessels. They need a thorough clearing and careful supervision afterwards in order to make them yield what they are capable of doing.

NEW YORK, N. Y., *October* 18, 1884.

17.—NOTES ON THE FISHERIES OF GLOUCESTER, MASS.

By S. J. MARTIN.

[From letters to Prof. S. F. Baird.]

MONTHLY SUMMARY.—The receipts of fish at Gloucester during the month of September, were as follows: From George's Bank, 3,126,000 pounds salt cod, 24,250 pounds fresh halibut; from Grand Bank, 3,225,000 pounds salt cod, 795,000 pounds fresh halibut, 40,200 pounds salt halibut; from Cape shore (Nova Scotia), 810,000 pounds salt cod; from Flemish Cap, 190,000 pounds salt cod, 17,000 pounds salt halibut; from Western Bank, 180,000 pounds salt cod, 1,000 pounds salt halibut; from Iceland (three vessels), 454,000 pounds salt halibut, 200 barrels halibut fins; from Greenland (five vessels), 348,000 pounds salt halibut, 140 barrels fins; from the mackerel fishery, 71,408 barrels salt mackerel from American shore; 6,244 barrels salt mackerel from Bay of Saint Lawrence; from the shore fishery, 373,000 pounds salt cod, hake, pollock, &c.; from the sword-fish fishery, 373 sword-fish weighing, 116,396 pounds

net, and 40 barrels salt sword-fish: from harbor traps, 515 barrels fresh mackerel, 385 barrels fresh herring; by freight from Maine, 3,650 quintals dry hake, 1,600 boxes smoked herring, 41 barrels fish oil. There were imported from Nova Scotia, 670 quintals dry fish.

The separate arrivals from the various grounds are given in my journal. Some of the Grand Bank cod were landed by British vessels, which are so marked in my journal.

GLOUCESTER, MASS., *October* 1, 1884.

HALIBUT FISHERIES.—The Greenland fleet this season consisted of seven vessels, all of which have returned. The first and second to arrive had full fares, having fished farther south than the others, near a place called Caud Hope. The schooner Mist, which was the last in starting, caught her fare off Cape Amelia, the other four caught their fares off Holstenburg. The weather at Greenland was fine, though there was one breeze of southwest wind, which lasted from July 6 to July 12. The halibut sold at 5 cents a pound, with the exception of that brought by the schooner Byron, of Nova Scotia. Her cargo sold at 6½ cents per pound, having been engaged when she sailed from home. The halibut fins sold at $9 a barrel.

The three Iceland vessels have returned with full fares. The Iceland halibut are larger than those caught on the Greenland coast.

COD FISHERY.—The George's fleet is doing well. The vessels leave home without any bait and catch plenty of squid on the ground. The squid extend 30 miles southeast from Cape Sable, on George's Bank, the whole length of the coast from Grand Manan to Cape Cod off shore and in shore. Squid have never been known to be so plentiful before. When squid is used for bait the vessels catch no halibut to speak of—rarely a small one.

MACKEREL FISHERY.—Mackerel are very plentiful. During September 72,000 barrels were caught on the New England coast by Gloucester vessels, and 6,000 barrels were shipped by rail from Canso, which had also been caught by Gloucester vessels. There are forty-one of our vessels in the Bay of Saint Lawrence, thirteen of which sailed within the last ten days. Yesterday mackerel were schooling from Thatcher's Island to Eastern Point. From the hill I counted twenty schools at one time. In the morning twenty vessels went out and returned at sundown with 150 barrels of mackerel each. Mackerel were so low yesterday that they brought only $3.25 per barrel out of pickle, the barrels costing 80 cents each. That left the fishermen only $2.45 a barrel. Of these 5 per cent. were No. 1; 33 per cent., No. 2; and 62 per cent. No. 3. This morning there are twenty vessels in the harbor dressing mackerel.

GLOUCESTER, MASS., *October* 5, 1884.

MACKEREL.—The market is overstocked with mackerel and some of the vessels have "hauled up." Out of 300 barrels caught, some vessels

have saved but 20 barrels of the largest mackerel, and thrown the rest overboard. Mackerel sold to-day at $3 a barrel as they run, including the barrel.

COD.—Some of the vessels that have been fishing on George's Bank have hauled up, because the owners could find no place for the fish. Every butt and all the wharves are full of fish. Large piles of kenched fish can be seen on all the wharves. There have been nineteen vessels from Nova Scotia, which landed 4,370,000 pounds of Grand Bank cod, which sold from the vessels, October 10, at $1.60 per 100 pounds. This is the lowest price for years.

HERRING.—There has been a large catch of herring at Wood Island, Maine, that lasted four nights, and a small catch at Marblehead. Otherwise the herring fishery is a failure. The temperature of the water when the herring were caught at Gloucester last year was 48°, and the temperature at Wood Island during the late catch was also 48°, but this year the temperature of the water at Gloucester has not been below 54°. Herring sold to-day for 75 cents per barrel, not including the barrel.

POLLOCK. To-day pollock sold at 30 cents per 100 pounds for round fish. Pollock is plenty and all kinds of fish sell very low.

GLOUCESTER, MASS., *October* 12, 1884.

MACKEREL.—Most of the mackerel fleet is hauled up, leaving only thirty sail on this shore and thirty sail in the Bay of Saint Lawrence.

SQUID.—Bait has been plenty all the fall. There is an abundance of squid in Boston Bay. Our harbor is full of half-sized herring.

GLOUCESTER, MASS., *October* 26, 1884.

I give below the amount of fish landed at this port during the month of October, 1884: Codfish from George's Bank, 2,870,000 pounds; halibut from George's Bank, 13,200 pounds; fish caught on the Cape shore, Nova Scotia, 580,000 pounds; codfish from Grand Banks, 1,370,000; salt halibut from Grand Banks, 9,800 pounds; fresh halibut caught on the Banks, 724,700 pounds; haddock from the Banks, 45,000 pounds; pollock caught in nets, 1,994,000 pounds; codfish caught in nets 68,000 pounds, and 7 sword-fish, weighing 2,218 pounds.

There also arrived by freight from Maine, 7,784 quintals of shore mackerel; 41,280 barrels of mackerel, and 4,565 barrels of mackerel from the Bay of Saint Lawrence.

The total number of barrels of herring landed was 2,538, most of which was caught in the harbors in nets and traps.

GLOUCESTER, MASS., *November* 4, 1884.

MACKEREL.—There are thirteen sail of the mackerel fleet in the Bay of Saint Lawrence, twelve sail on the shore of Nova Scotia, and ten sail in Barnstable Bay. Those fishing in the latter place carry their mackerel fresh to Boston. During the past four days, there have been seven

arrivals from the Bay of Saint Lawrence with good fares. Schooner Lizzie Center arrived yesterday with 320 barrels, making its catch since July 1st an aggregate of 1,055 barrels of salt mackerel. This vessel claims to be "high line" of the Bay of Saint Lawrence fleet. All the vessels report mackerel plenty when they left, but that they have had no weather suitable to catch them.

The mackerel went into the Bay of Saint Lawrence very late, which was doubtless due to the fact that the ice did not leave the bay until June 2, consequently the mackerel will be late coming out. No mackerel were caught in the bay until August. The mackerel caught there this fall were large and fat.

Schooner John S. McQuinn had a fare of 340 barrels packed, of which 300 barrels were No. 1; and the fares of the other vessels run about the same. The schooner Spencer F. Baird left Gloucester September 2, and arrived home November 6, with 360 barrels of No. 1 mackerel, having lost 50 barrels overboard. The Bay mackerel sold yesterday at $12.75 a barrel for the trip as they run.

There have been no large mackerel caught on the Cape shore as yet, though on November 4 some vessels caught small mackerel there about the size of those which have appeared on this coast. I am of opinion that no large mackerel will be caught on the Cape shore until the middle of this month. Vessels catch some small mackerel in Barnstable Bay when the weather permits. No mackerel have been taken at Seven Islands this year. The mackerel season is nearing its close.

GLOUCESTER, MASS., *November* 9, 1884.

SQUID AND MACKEREL.—Squid are very plenty from Cape Cod to Cape Breton Island. They are also very plenty on the Nova Scotia shore. The mackerel fishers are being troubled by having their mackerel devoured by squid before they can get them out of the nets. Captain Martin, of the schooner Martha C., arrived home from North Bay last night, and says that at Sidney he could dip them up with a dip net by simply throwing a little bait overboard. The schooner Orient, Captain Charles Lee, reports having seen off Halifax, in a boat that came alongside, 280 heads and backbones of large mackerel from which the squid had eaten all the flesh. The same difficulty is experienced all along the New England coast. Boats from Gloucester have to remain outside Eastern Point but an hour to catch all the squid they want for the day's fishing. Even boys go out in the evening and get home at 9 o'clock with from eight to ten buckets of squid to be used for bait.

MACKEREL.—Mackerel fishing is most over, and vessels fishing on this shore having been all hauled up except a few market boats. These caught a few small mackerel in Barnstable Bay yesterday. There are a few small mackerel in the harbor. The North Bay fleet is fast arriving home, mostly with small fares. Captain Martin, of the schooner Martha C., reports plenty of large mackerel schooling off Halifax, No-

vember 4, and the keeper of the light-house on Saint Paul's Island, which is situated at the mouth of the Bay of Saint Lawrence, told him that large mackerel were schooling around that island during all the months of July, August, and September. This was attributed to the temperature of the water.

PRICES.—Fish of all kinds, except halibut, bring a very low price, and gill-netters sold large cod for $1 per 100, and pollock for 45 to 50 cents per 100 pounds. Shore mackerel bring $3.50 per barrel, including the barrel, when taken by the cargo. No. 2 mackerel brings $7.50, and No. 1, $15 per barrel. Some large No. 1, from Bay of Saint Lawrence, have been sold for $12.50 per barrel. Halibut brings 20 cents a pound.

GLOUCESTER, MASS., *November* 16, 1884.

SUMMARY.—During the month of November there have been landed at Gloucester 1,103,000 pounds of codfish, and 17,550 pounds of halibut from George's Banks; 205,000 pounds of fish caught on the Nova Scotia shore; 101,000 pounds of fresh halibut from Grand Banks; 1,057,000 pounds of pollock and 883,000 pounds of codfish caught in cod gill-nets; 31,000 pounds of codfish caught by small boats with hand lines on the shore grounds; 94,000 pounds of haddock, 68,000 pounds of hake, 2,600 quintals of dried mixed fish on freight from Maine; 7,880 barrels of mackerel from the Bay of St. Lawrence; 4,170 barrels of shore mackerel, and 37 barrels from Nova Scotia.

There were landed at Rockport during the month of November 293.000 pounds of codfish and 105,000 pounds of pollock, and at Lynn, 268,000 pounds of codfish and 80,000 pounds of pollock, which were also caught in nets.

HERRING AND HALIBUT.—All but one vessel of the mackerel fleet is at home. The vessels are now fitting out for the Newfoundland herring fishing. I think twenty-five vessels will go to Newfoundland for frozen herring. Some vessels are also fitting out for Grand Manan to get frozen herring. The schooner Wachusett has brought in 79,000 pounds of codfish and 1,000 pounds of halibut from Brown's Bank, all of which was caught on hand-lines. The schooner was gone from home only twenty days, and the fare is considered the largest ever landed here for so short a time. The bait used was squid, which was caught on the ground. The codfish sold for 2½ cents and the halibut for 19 cents a pound

MACKEREL.—The Portland Press says: "The mackerel season has been noted for the great catch of small fish. The net stocks of the vessels have been small for the amount of the catch, although a few vessels have done a good season's work. The stock of large mackerel at Portland is nearly exhausted, but there is a large stock of smaller sizes owned by parties who bought them at low prices. As the quality of the fish is exceedingly good a very decided advance is looked for after the holidays.

"The aggregate number of barrels packed at Portland will reach nearly 125,000, one firm having packed 25,000 barrels, and two others about 20,000 each. The fleet of Portland mackerel vessels is growing rapidly, and now ranks next in size to that of Gloucester."

GLOUCESTER, MASS., *December* 2, 1884.

DESTRUCTIVENESS OF SQUID.—On the Nova Scotia shore squid have destroyed *all* the mackerel and herring that were caught in the nets. My son, George H. Martin, was on the Nova Scotia shore four weeks, and tells me that during that time he never saw a mackerel that had been taken out of a net which was fit for market. When squid was plenty on the New England coast, the fishermen had their nets set for herring. That squid would destroy three out of ten barrels taken, I am informed by men who were in the business.

I have been informed that by holding in the water a scrub broom that had been dipped in the gurry pen three and four squid could be taken at a time; and, moreover, that if a strad.* such as is used on a cable at anchor, be lowered in the water after being placed in the gurry pen it is possible to take from three to eight squid at a time. Squid are very plenty on all the outer grounds, but since the last easterly gale, they have moved off shore. Fishermen say that they have never seen squid so plenty as on George's Bank, where they have been of much benefit to the vessels which have arrived there during the last fifteen days. The vessels which carried herring for bait did not need them, and so threw them away.

GLOUCESTER, MASS., *December* 7, 1884.

Pollock have left the inshore grounds. I think cod gill-nets are suitable to catch puffers. There have been eight caught in the nets since the 15th of October. In summer they are very plenty in Boston Bay, close to the shores.

The fishing season is over, and all but seven of the George's fleet have hauled up. They will, however, start out again in January. Twenty-one vessels have sailed for Newfoundland, with seven more to follow, and two have sailed for Grand Manan. These vessels have gone for frozen herring. Nine vessels will also go from Nova Scotia to Newfoundland for frozen herring.

Vessels fishing for halibut have found them very scarce. Two vessels arrived yesterday, each with fares of 20,000 pounds. The vessels have been gone from home six weeks.

GLOUCESTER, MASS., *December* 14, 1884.

* A strad is made of three strands of rope braided together, and tapering to a point at each end. It may vary in length from 1 to 2½ fathoms, but is generally 9 to 10 feet long. The strands are taken from manilla rope of 2½, 2¾ and 3 inches in circumference. Strads are wound around a cable to prevent it from chafing in the hawse-pipe, and about the head-stays.—J. W. COLLINS.

18.—THE WHALE FISHERY OF NORWAY.

By NIELS JUEL.

The whale fishery began in 1864 and was carried on till 1868 by one steamer, and then till 1877 by two steamers belonging to the same company. In 1877 the number of establishments (companies) rose to 2; in 1881 to 5; in 1882 to 8, which used 12 steamers, and in 1883 to 14, with 23 steamers. Of these, 11 are in East Finmark—east of Cape North—and three in West Finmark, between Cape North and the town of Hammerfest. The catch was:

Year.	Whales.	Year.	Whales.
1866	0	1877	32
1867	1	1878	130
1868	30	1879	123
1869	17	1880	145
1870	36	1881	279
1871	20	1882	386
1872	40	1883	506
1873	36	1884	416
1874	51		
1875	37	Total	2,327
1876	42		

In 1872, 1877, and 1878, whaling was tried in the Strait of Davis by one vessel* but without success. Last year, Mr. Svend Foyn, who is the creator of the Norwegian whale fishery in Finmark, put up an establishment in Iceland. This year he got 22 whales there. Besides, whales are occasionally taken by fishermen, who shoot them with arrows. In the waters of Spitzbergen there are taken every year by vessels fitted out from Tromsoe about 150 to 250 so-called white whales (*Delphinapterus leucas* Pallas), by means of nets, 1,100 to 1,200 meters long with meshes of 0.16 m.

The whales taken in Finmark belong to the two species: *Blaahvalen* (*Balænoptera sibbaldii* Gray)† and *Finhvalen* (*Balænoptera musculus* Comp).‡

The steamers used are built of iron, have a burden of 32 registered tons net, and an engine of 25 to 35 nominal horse-power. The length is 22.5 to 26.7 meters, the breadth 4.0 to 4.3 meters, and the draught 2.5 to 2.8 meters. They are rigged as fore-and-aft schooners. Below deck are only the engine, the cabins, and a place for the cordage, as the whales are always towed ashore either by the steamers or by a tug-boat. The crew consists of 9 men; viz., the captain, 1 gunner, 3 engineers, 1 steward and 3 sailors. The speed is 9 knots.

* One of those engaged in the Jean-Mayn seal hunting.

† 1 Blaahval yields 90 and 1 Finhval 40 hectoliters of oil.

‡ *Knolhval-Megaptera boops* (Fabricius) is also 10 m. times taken.

The guns used are muzzle-loaders of steel with steel-coils and mounted on swivels. The length 1.2 meters and caliber 0.078. The charge 0.34 kilograms. They are fired at a distance of 20 to 40 meters. The gunner tries to hit the whale between the ribs as near the spinal column as possible.

The gun-harpoon used was invented by Mr. Svend Foyn about 1860, and patented in 1882, when the patent went out in Norway. It consists of:

Shell, diameter	meter..	0.104
Shell, length	do....	0.319
Charge	kilogram..	0.5
Barb-holster, length	meter..	0.319
Pole, length	do....	1.307

The shell is screwed to the barb-holster, which contains a glass filled with sulphuric acid. To the pole is attached the rope, 0.143 meter in circumference and 733 meters long, with a ring running on the pole. The weight of the rope, which is of hemp, is about 1,450 kilograms.

When the harpoon is to be used, the barbs that are pivoting are secured to the pole by rope-yarn and the shell screwed on the holster. As the number of barbs are four, the shell and the holster that turn in the ring at the end of the pole when they are free, now form with the pole a solid mass. When the harpoon penetrates the whale the rope-yarn slips off, the barbs turn so as to make an angle with the holster crushing the glass tube, and the sulphuric acid that communicates with the powder in the shell through a channel in the screw makes it explode.

Most whales sink. When they do not sink, several whalers are of the opinion that the respiratory organ is filled with coagulated blood impeding the inhaled air in getting out again. The reason for this theory is, that very little blood comes through the nostril of a whale that does not sink. No hand-harpoons are used.

The manner in which the fisherman kill the whale by means of arrows and cross-bow is as follows: When a whale enters a bay the passage is barred with a strong net, and the whale is shot. They let him go for two or three days inside. The arrows contain no poison, but later investigations have led to the discovery of a peculiar bacilla, that lives on arrows already used, and which poisons the blood. Only old arrows of iron are esteemed, and now we know the reason why. After some days the whale appears to be dying and is dispatched with knives and harpoons. The flesh is eaten with the exception of the parts around the wounds, where is formed a tumor. The whale ordinarily taken in this manner is the *Balænoptera rostrata* Fabricius. The number may amount to 15 or 20 a year.

BERGEN, NORWAY, *September* 22, 1884.

Vol. V, No. 5. Washington, D. C. January 19, 1885.

19.—NOTES UPON FISH AND THE FISHERIES.

Compiled by CHAS. W. SMILEY.

[Mainly derived from the official correspondence.]

RESUSCITATING FISH.—An experiment by Mr. C. W. Scudder, of the United States Fish Commission, in using brandy to recover carp nearly on the point of expiration, which was described in Bulletin Fish Commission, 1884, page 179, having come to the notice of Mr. W. Oldham Chambers, secretary of the National Fish Culture Association, of London, the latter conducted a similar experiment in the presence of several gentlemen at South Kensington, in September, 1884, and has recorded the verification of Mr. Scudder's work as follows:

"Taking two Prussian carp from the tanks of the aquarium, he deposited them in separate dry cans, adorning one with blue ribbon to denote its enforced temperance principles and to distinguish it from the other, which was selected for the administration of spirituous liquors. After a lapse of four hours the fish were placed in water, evident signs of expiration being apparent in both cases. A small quantity of brandy and water was then given to the carp selected for the imbibition of intoxicating liquors through the medium of a feather, and no sooner was the fish replaced in water than it assumed its normal condition and seemed to be restored to vigor and strength. The carp enlisted under the banner of the 'blue-ribbon league' to all appearances died half an hour after its more fortunate associate, and was taken out of the water and thrown on the ground. About four hours later, however, the fish was picked up by Mr. Chambers, who observed it by appearance to be *in rigor mortis*. He then at once operated on the seemingly inanimate fish by opening its mouth and pouring a dose of brandy and water down its throat, and again inserting it in the water, when, to his utter astonishment, he noticed slight signs of animation. For five minutes the unfortunate object of the experiment floated helplessly on its side, when presently, to the still greater astonishment of the secretary and those who watched the experiment, it gradually asserted itself in the water, and with considerable effort made use of its fins—feebly at first, but afterwards energetically. Both the resuscitated fishes, which show no signs of their late prostration, now swim about with their *confréres* in the tanks as usual.

"The instantaneous reanimation produced to the carp in the first instance was indeed remarkable; but what can be said of the latter, which recovered after remaining out of water for eight hours? Surely

this discovery will prove of the greatest utility and value in restoring fish that would otherwise perish, and be the means of securing greater longevity amongst them.

"Experiments in relation to brandy as a means of restoring suspended animation with quick-dying fish resulted equally as satisfactory. It was highly interesting to see the plucky manner in which a trout (*S. ferox*) battled with his fainting condition and came out the conqueror. Strange to say, the salmon (*S. salar*) did not once attempt to rouse himself after being dosed, the consequences being fatal to him; this was the only fish that succumbed under the treatment. The dace (*Leuciscus vulgaris*) was out of water three times of five minutes each. He was exceedingly faint and almost dead; but immediately after the brandy was given, he pulled himself together, and in the course of a few minutes not only recovered, but darted round the can with a rapidity positively amazing."

It is suggested that a judicious administration of brandy to a dace prior to being used for bait will not only restore an inanimate bait, but also increase its strength and vigor, thus proving of much service to the angling fraternity.

Upon the publication of the above Mr. Henry Lee immediately published in Land and Water (November 1, 1884, page 437) the history of previous experiments in this direction, as follows:

"It seems to have been assumed that the administration of brandy as a restorative to a fish is a novelty. It was, however, practiced long ago by the Dutch, and the recipe for this treatment was probably of ancient origin. Mention of it may be found in the works of many authors, one of the most generally accessible being the article on Ichthyology in the seventh edition of the Encyclopædia Britannica, which was written by James Wilson, F. R. S. E., in 1838. He says: 'Carp can be preserved alive for a considerable time out of water, especially if care be taken to moisten them occasionally when dry. Advantage is often taken of this circumstance to transport them alive by packing them among damp herbage or wet linen, and the operation is said to be unattended with any risk to the animal, especially if the precaution be taken to put a piece of bread steeped with brandy in its mouth. In a similar way the Dutch preserve carp by suspending them from the roof of a damp apartment in a bag-net filled with moss, which is continually kept moist, and they are fed with vegetables and bread steeped in milk, a mode of treatment by which they are not only kept alive but actually thrive and fatten.'

"C. Millet, also, in his book *La Culture des Eaux*, writes that if carp thus suspended in wet moss or grass be fed on bread steeped in wine for some days before they are killed and cooked they acquire a superior flavor. I am inclined to believe, however, that the retention of life by a carp after swallowing brandy is rather an additional demonstration of

the strong vitality of this exceptionally hardy fish, and of its power of surviving maltreatment, than a proof that alcohol is really beneficial to it."

ACCOUNT OF A TRIP MADE BY FISH COMMISSION CAR NO. 3. IN NOVEMBER AND DECEMBER, 1884.—Mr. J. Frank Ellis, messenger in charge, has made a report, from which the following extracts are made, to illustrate the work of his car.

Account of trip with car No. 3, from Washington to Saint Louis, Topeka, Denver, Ogden, and Omaha, and return. The crew consisted of Messrs. Johnson, Tune, and Goldsmith.—On November 19 received from J. E. Brown 8¾ pails, said to contain 17,000 carp, 200 tench, and 200 gold fish. Car left Washington on the 7.40 p. m. train, Pennsylvania Railroad, Wednesday, November 19, arrived at Saint Louis Friday morning, November 21. Shipped from this place the fish for Arkansas, Missouri, and 6 pails for Illinois. Gave to the Pacific Express Company 55 pails, and to Adams Express Company 94 pails. Sent out the notices to applicants in Kansas. Saturday, November 22, saw Mr. Hoxie, and made arrangements to go to Kansas City on to-night's train free. Got to Kansas City Sunday morning, November 23. Commissioner Giles, of Kansas, met me at the depot. Went to the Atchison, Topeka and Santa Fé Railroad office, but, it being Sunday, could find no one there, so made arrangements to go to Topeka via Union Pacific Railroad.

The pipes under our car got frozen to-day. Commissioner Giles added a great many names to our list. He wished me to do all the shipping. Left Kansas City on a fast-freight train, and got to Topeka at 11 o'clock p. m.

Monday, November 24, we had great trouble in getting the water from the car, as the pipes were frozen. Changed the water on the fish, and shipped by the Pacific Express Company 140 pails, and by Wells, Fargo Company 143 pails. Most of the applicants at Topeka called at the car for their fish. Commissioner Giles gave out a great many from his 1,000 extra carp. Only 10 dead fish thus far. Sent out the notices to applicants in Colorado. Fish to be shipped the 26th instant. Commissioner Giles wished his tench, also his extra carp, left at Brookville, on the Union Pacific Railroad, so made arrangements to go via that line to Denver. Left Topeka at noon on the 25th instant. Put off the tench, &c., for Commissioner Giles at Brookville at 6 o'clock p. m.

Arrived at Denver Wednesday morning. Shipped by the Pacific Express Company 9 pails, and Wells, Fargo Express 23 pails. Could not find all the applicants at Denver to-day. Delivered the balance of the carp for Colorado on Thursday, the 27th instant. Made arrangements to go to Ogden to morrow. Sent out the notices to applicants in Utah, California, &c. Fish to be shipped next Monday. Left Denver for Ogden at 1.20 p. m., Friday, November 28. Arrived at Cheyenne at 6

o'clock p. m. Was delayed here nearly two days by the burning of the Dale Creek bridge, near Sherman.

Delivered 1,000 carp to Otto Gramm, commissioner of Wyoming, at Laramie City, on Sunday, the 30th instant. Arrived at Ogden at 11 o'clock, Monday, December 1. Was met at depot by about twenty applicants. Delivered the fish immediately, and also gave the fish to express company this noon. Gave the Pacific Express 22 pails, and Wells, Fargo Express 26 pails.

Mr. Musser, commissioner of Utah, called at 5.30 p. m., and made arrangements for car to go to Salt Lake. Left Ogden at 6.30 p. m., and arrived at Salt Lake at 7.30 p. m., Tuesday, December 2. Delivered quite a lot of fish to day. Mr. Musser had about twenty new applicants, indorsed by Mr. Caine. These I filled for him. Mr. Musser made arrangements for car to go south to Juab to-morrow morning. Left Salt Lake on the 7.30 a. m. train, Wednesday morning, December 3. Supplied all applicants on the Utah Central Railroad *en route*. Mr. Musser accompanied us. Met Mr. Crockwell at Deseret. Gave him 14 pails of fish. Thursday, December 4, arrived at Millford this morning, and delivered 43 pails to one man who will take them over the mountains 100 miles. The Utah Central furnished us a special engine to take us back to Juab, 121 miles. Arrived at Salt Lake this evening.

Left Salt Lake City for Omaha, Friday, December 5, and arrived at Omaha at 7.50 Monday morning, December 8. Delivered to Pacific Express Company 10 pails of carp, and to Wells, Fargo Express 26 pails. Commissioner Kennedy was at the depot. Gave him 1,460 carp, and 20 gold-fish. This ended the distribution for this trip. We lost only 130 carp in all. Tuesday, December 9, made arrangements with Mr. A. A. Talmage, of the Wabash Railroad, to go to Fort Wayne free on to-night's train. Left Council Bluffs at 4.30 p. m., Tuesday, and arrived at Fort Wayne at 11.30 p. m., Wednesday. The last 20 miles of the run they furnished us with a special engine. Left Fort Wayne immediately, and arrived at Pittsburgh at noon, Thursday, and at Washington 9 o'clock Friday morning. Reported at office at 10.30 a. m.

Number of miles run on this trip	5,456
Number miles car run free	1,458
Number carp lost on trip	130

WASHINGTON, D. C., *December* 12, 1884.

DEPOSITS FROM SEAWATER IN WOOD'S HOLL HARBOR.—Under date of December 8, 1884, Mr. John A. Ryder reports:

"The sediment or so-called rust deposited from sea-water sent by Chester from Wood's Holl contains an abundance of a number of species of Diatoms, amongst which I have noticed *Arachnodiscus* (?), *Navicula*, *Bacillaria*, and others. Fragments of the Spicules of *Microciona*: very fine filaments of *Oscillatoriæ*: fragments of Algæ; joints of Sertularians; particles of sand; tests of *Tintinnus*. Besides fragments of

chitin from crustaceans, very young plants of *Fucus*, besides many other objects which might be identified. So that the organic matter is abundant. The Diatoms are most plentiful and constitute possibly one-tenth of the whole amount of the substance. Dr. Kidder has made some preliminary chemical tests upon which he will doubtless report."

NOTES UPON FISH AND OTHER OBJECTS ON CAPE COD.—Under date of October 31, 1884, Mr. Vinal N. Edwards, who had just made a tour along the shore, reports the traps of North Truro, Mass., full of herring, constituting the largest run for many years. Some tautog, kingfish, butterfish, and pollock were also taken. There were also some small mackerel, but very few large ones taken. Most every day one or more puffing-pigs were taken and tried for oil. One man has had over a hundred of the common kind this fall.

At Nausett light there is a shell fish* coming ashore quite plentifully. A keeper says he has taken up at one time a bucketful of live ones immediately after a gale. Some samples will be sent to Washington.

From Nausett Harbor to Truro, and even further north, a kind of moss,† which the people call "ooze," has been coming ashore. It extends about 200 yards into the ocean. In May the water begins to grow red with this ooze, which grows thicker and thicker until the middle of November, when it disappears altogether. The color when it comes ashore is scarlet, and when dry on beach its color is green. When put in alcohol it becomes colored like the sand dollar.

THE PROPER MODEL FOR FISHING VESSELS.—Captain Collins has for some time been urging a change of the model of American fishing vessels. The most important feature is indicated in his note in the Cape Ann Advertiser of May 19, 1882, as follows:

"All evidence goes to prove that in the open ocean, especially where strong winds and rough seas are to be encountered, deep-bodied vessels are much more rapid than shallow ones. Nor does this depend so much on the vessel carrying a great amount of sail as it does on her ability to keep on her course and make headway under short canvas when one of less depth, though of broader beam, must heave to and drift to leeward."

These statements have been verified in a very interesting way the past summer by the Gloucester vessels sent to Iceland on halibut voyages, where they came in contact with English smacks. Capt. George W. Pendleton, master of schooner Alice M. Williams, which is one of the best Gloucester vessels, reported that on the day he sailed from Iceland he encountered a gale and was obliged to heave to under double-reefed foresail when some 40 miles off land. Soon after he heaved to he was

* Identified as *Ceronia arctata* (Con.) H. and A. Adams. Gould, Inv. Mass., II, p. 80, 1870. Verrill, Inv. V. S., p. 679, 1874. Rathbun, Proc. N. M., III, 1880, p. 128.

† Identified by Prof. W. G. Farlow as the sea-weed *Ectocarpus*, and probably of the species *siliculosus* which is common on the Massachusetts coast.

passed by an English smack, carrying a single-reefed mainsail and whole foresails. He thought the English vessel was making 11 knots an hour. Everything was dry and comfortable, the men appearing on deck without oiled clothes. On other occasions he was obliged to reef down snugly while the English smacks went along comfortably under all plain sail. The Alice M. Williams was deep in water, as she had a full cargo of fish on board, and yet was compelled to lay to while another vessel no larger was moving comfortably under crowded canvas.

September 25, 1884.

LOSS OF WEIGHT IN FISHES AFTER CAPTURE.—In view of the general belief that fishes diminish in weight after capture, Dr. J. H. Kidder, U. S. Navy, has made some observations at the request of the Commissioner, Professor Baird. The supposed loss of weight is not verified by his report of November 3, 1884, which is tabulated as follows:

Date.	Kind of fish.	Weight when caught.	Weight after an interval.		Loss of weight.
1884.		*Ounces.*	*Hours.*	*Ounces.*	*Ounces.*
Sept. 29	Bluefish	84	2½	84	0
29	....do	96	2½	96	0
29	....do	144	2	144	0
29	Sea bass	48	1¾	48	0
Oct. 3	Flounder	64	3	64	0
3	Flounder (same)	64	23	62	2

The flounder weighed October 3 showed no loss after three hours had elapsed, and the loss of 2 ounces sustained after twenty-three hours had elapsed is probably explained by the fact that the fish had become externally quite dry and stiff.

FISH-CULTURE IN CANADA.—Under date of Ottawa, May 28, 1883, Mr. W. F. Whitcher gives the following summary:

Canada has eleven Government hatcheries now in operation, eight of which are occupied in hatching salmon eggs only, besides two private ones, which also hatch the true salmon. Two are employed in hatching salmon, whitefish, and trout eggs, and one hatches whitefish and pike perch. The earliest of these hatcheries has been in operation for about fifteen years, and the latest for two years. The principal ones have existed since 1873. Their entire cost to date has been $259,400.

The whole number of fish bred and distributed from 1868 to 1881 is about 105,000,000, of which about 20,500,000 were salmon and about 69,500,000 were whitefish.

The total catch of these two kinds of fish in the five provinces where hatcheries exist is given in the census returns as follows:

Kind of fish.	1871.	1881.
	Pounds.	*Pounds.*
Salmon	3,263,200	4,754,800
Whitefish	4,603,400	7,848,200

Appropriations for the United States Fish Commission work, 1871–'85.

Fiscal year.	Food fishes inquiry.	Illustrations	General work of propagation.	Hatcheries, ponds, and distribution.	Steam vessels.	Railroad cars.	Rent of office.	Buildings at Wood's Holl.	Total.
1871–'72	$5,000 *3,500								$8,500 00
1872–'73	5,000	$500	$15,000 00 *10,000 00						30,000 00
1873–'74	5,000	1,000	17,500 00 *15,000 00						38,500 00
1874–'75	5,000	1,000	17,500 00						23,500 00
1875–'76	5,000	1,000	47,500 00 17,500 00						71,000 00
1876–'77	5,000	1,000	30,000 00 *45 00						36,045 00
1877–'78		1,000	50,000 00 *17,500 00	$2,200 00					70,700 00
1878–'79		1,000	20,000 00 50,000 00	5,000 00					76,000 00
1879–'80	3,500	1,000	75,000 00 15,000 00	5,000 00	$45,000 12,500				157,000 00
1880–'81	3,500	1,000	85,000 00	5,000 00 12,000 06	15 000				121,500 00
1881–'82	3,500	1,000	95,000 00 35,000 00	5,000 00 10,000 00 *5,001 45	15,000 115,709 *42,000		$1,500		328,710 45
1882–'83	3,500	1,000	115,000 00 *579 60	30,000 00	25,000 45,000	$8,000	1,500		229,579 60
1883–'84	3,500	1,000	125,000 00	30,000 00	10,000 35,000 *6,000	5,500	1,500	$25,000	242,500 00
1884–'85	3,500	1,000	125,000 00	45,000 00	45,000	4,500	1,380	20,000	245,380 00
Total	54,500	12,500	978,124 60	154,201 45	411,209	18,000	5,880	45,000	1,679,415 05

* Deficiency appropriation.

1879–'80. Appropriation for the International Fishery Exhibition in Berlin, $20,000.
1882–'83. Appropriation for the International Fishery Exhibition in London, $50,000.
1883–'84. Deficiency appropriation for the International Fishery Exhibition in London, $20,000.

Statement compiled from the customs returns of the receiver-general of the exports of fishery products from Newfoundland to all countries during the year ending December 31, 1883.

Articles.	Quantity.	Total value.
Dry codfish, at $3 to $5.20 ..... quintals..	1,163,934	$4,725,960
Core fish, at $2 ..... do....	1,372	2,744
Pickled codfish, at $2 ..... do ...	947	1,894
Pickled Labrador herring, at $3.20 ..... barrels..	19,001	60,803
Pickled shore herring, at $2.50 ..... do ...	44,383	110,958
Pickled salmon, at $22 ..... tierces..	4,046	89,012
Pickled mackerel, at $3 ..... barrels..	4	12
Pickled trout, at $8 ..... do....	532¾	4,262
Ling, at $2 ..... quintals..	44	88
Haddock, at $2.60 ..... do....	470	1,222
Turbot, at $10 ..... barrels..	10	100
Caplin, at 50 cents ..... do....	115	58
Pickled halibut, at $6 ..... do....	4	24
Lobsters, at 10 cents ..... pounds..	505,968	50,597
Cod-roes, at $3 ..... barrels..	179	537
Tongues and sounds, at $3 ..... do....	54	162
Frozen herring, at $2 ..... do....	5,240	10,480
Fish guano ..... tons..	193½	6,000
Codfish oil, at $124 ..... tuns..	2,936¾	364,157
Codfish oil, refined, at $192 ..... do....	404	77,568
Seal oil, at $124 ..... do....	5,340¾	662,253
Herring oil, at $96 ..... do....	14	1,344
Whale oil, at $108 ..... do....	38¾	4,158
Blubber, at $14 ..... do....	54	756
Seal skins, at $1	322,603	322,603
Seals, at $2	300	600
Whalebone, at $15 ..... cwt..	25	375
Total	.....	6,498,727

Statement by countries of the quantities of fishing products exported from Newfoundland in 1883.

Articles.	To the United Kingdom.	To Canada.	To the United States.	To the West Indies.	To Spain, Portugal, and Gibraltar.	To all other countries.	Total.
Dry codfish ..... quintals..	45,107	36,055	45,693	98,913	573,181	*364,985	1,163,934
Core fish ..... do....	.....	.....	1,300	.....	.....	†72	1,372
Pickled codfish ..... do....	.....	947	.....	.....	.....	.....	947
Pickled, herring, Labrador. bbls..	5,979	4,858	8,164	.....	.....	.....	19,901
Pickled herring, shore ..... do....	.....	31,106	8,233	4,971	.....	†73	44,383
Pickled salmon ..... tierces..	623	781⅓	1,964⅓	502	7⅓	‡167⅔	4,046
Pickled mackerel ..... barrels.	.....	.....	3	1	.....	.....	4
Pickled trout ..... do....	15	23	430	64¾	.....	.....	532¾
Ling ..... quintals..	.....	.....	.....	44	.....	.....	44
Haddock ..... do	.....	.....	.....	470	.....	.....	470
Turbot ..... barrels..	.....	.....	.....	3	.....	†7	10
Dried caplin ..... do....	94	.....	.....	21	.....	.....	115
Pickled halibut ..... do....	.....	4	.....	.....	.....	.....	4
Lobsters in tins ..... pounds..	323,568	105,648	76,752	.....	.....	.....	505,968
Cod-roes ..... barrels..	135	.....	.....	.....	.....	†44	179
Tongues and sounds ..... do	13	.....	35	.....	.....	†6	54
Frozen herring ..... do....	.....	550	4,690	.....	.....	.....	5,240
Fish guano ..... tons..	193¾	.....	.....	.....	.....	.....	193¾
Codfish oil ..... tuns..	2,593	279⅓	143¾	2	.....	†111	2,936⅔
Codfish oil, refined ..... do....	219	59	124	.....	.....	.....	404
Seal oil ..... do....	3,681½	391½	6½	.....	.....	§1,261½	5,340⅔
Herring oil ..... do....	14	.....	.....	.....	.....	.....	14
Whale oil ..... do	38	⅓	.....	.....	.....	.....	38⅓
Blubber ..... do....	1	53	.....	.....	.....	.....	54
Seal-skins	320,912	1,691	.....	.....	.....	.....	322,603
Seals	.....	300	.....	.....	.....	.....	300
Whalebone ..... cwt..	25	.....	.....	.....	.....	.....	25

* Of this amount, 295,094 quintals went to Russia.
† To Jersey.
‡ Of this amount, 1,220½ tuns went to Hamburg.
§ Of this amount, 164⅓ tierces went to Italy.

Statement compiled by the customs returns of the receiver-general of the exports of fishery products from Newfoundland to the United States during the year ending December 31, 1883.

Articles.	Quantity.	Total value.
Dry codfish, at $5.20 ..... quintals..	45,693	$237,604
Core fish, at $2 ..... do....	1,300	2,600
Pickled Labrador herring, at $3.20 ..... barrels..	8,164	26,125
Pickled shore herring, at $2.50 ..... do....	8,233	20,583
Pickled salmon, at $22 ..... tierces..	1,964⅓	43,216
Pickled mackerel, at $3 ..... barrels..	3	9
Pickled trout, at $8 ..... do....	430	3,440
Preserved lobsters, in tins, at 10 cents ..... pounds..	76,752	7,675
Cod tongues and sounds, at $3 ..... barrels..	35	105
Frozen herring, at $2 ..... do....	4,690	9,380
Codfish oil, at $124 ..... tuns..	143¾	17,763
Codfish oil, refined, at $192 ..... do....	124	23,808
Seal oil, at $124 ..... do....	6½	806
Total	.....	393,114

RESUSCITATION OF CARP.—October 15, 1884, Mr. E. G. Blackford received at the Fulton Market, in New York, 30 pounds of large carp which had been taken from the ponds of Prospect Park, Brooklyn. They were brought over in a box, and after having been out of the water two hours Mr. Blackford placed them in water and they all revived immediately.

Quantities of fishery products exported from Labrador for the year ending December 31, 1883.

[From the report of Hon. W. J. S. Donnelly, receiver-general of customs for Newfoundland.]

Dried codfish	quintals..	368,089
Pickled salmon	tierces..	899
Preserved salmon	tins..	23,000
Pickled trout	barrels..	547
Pickled herring	do....	54,162
Seal skins	number..	490
Seal oil	tuns..	26
Cod oil	do....	21
Blubber	do....	3

OYSTER CULTURE AT COLD SPRING HARBOR, NEW YORK.—Mr. Henry C. Bunce has for several years past with much persistency continued throwing overboard on his oyster grounds every season thousands of bushels of tin cans, hoop skirts, branches of trees, and other rubbish of various kinds. He now finds a splended set of oysters on these odd receptacles. Some old hoop-skirt frames and tin cans contain hundreds of the young oysters nicely started, while the boughs of trees are thoroughly weighted down with them. The theory of Mr. Bunce is that the spawn floats along about a foot or more from the bottom and is more readily collected by the boughs and preserved. In support of this theory he finds boughs at the height of a foot or more from the bottom covered with the small seed oysters, while the shells on the bottom near and surrounding these boughs contain none. The boughs will in time rot down and the large oysters find a secure resting-place on the bottom.—*October*, 1884.

PROPOSED OYSTER PLANTING IN A SALT LAKE.—Writing from Rix's Mills, Ohio, under date of November 17, 1884, Mr. B. V. Moore says: "I am about removing to Texas, and the region where I intend to locate contains a salt lake covering perhaps 500 acres. I would be very glad to make an experiment with oysters in this salt lake to see if they can be propagated therein."

RESULTS OF OYSTER EXPERIMENTS AT SAINT JEROME IN 1884.—Writing from Saint Jerome Station October 20, 1884, Mr. W. de C. Ravenel reports: "On Saturday I took up all of the collectors that I put in the first pond except the shells that were sowed on the bottom, and found 18 young oysters attached, varying in size from one-half an inch to two and one-half inches in diameter. I think that we may find more on the shells in that pond. I also took up the collectors in the small pond and found 3 in that, all on slate collectors. I have not taken up the collectors in the other three ponds, though I have examined a great many of them, and can find no oysters at all. I had the collectors that had nothing in them put away for future use, and those with oysters attached put back in the ponds."

Shipments of salmon from Portland, Oreg., to San

[In

Date.	Vessel.	From												
		Wm. Hume.	Cutting Packing Company.	Thomes & Knowles.	Washington Cannery.	G. W. Hume.	Astoria Packing Company.	Scandinavian Company.	I X L Company.	Tillar Rock Company.	J. O. Hanthorne Company.	Eureka Packing Company.	A. Booth & Sons.	
April	6	Steamer Oregon	24	63	494									
	10	State of California		60										
	14	Columbia		69		1								
	18	Steamer Oregon		208										
	22	State of California		100			100	126						
	26	Columbia		400										
May	8	Columbia		500			562	83	200	300	250	1	4	
	16	State of California										134	538	300
	24	Steamer Oregon					5						345	
	28	State of California	600	1,000		1,000	1,000		300					
June	1	Columbia		1,000		507		450						500
	6	Steamer Oregon	1,200											
	11	State of California		100		500	200					700		
	16	Columbia				500		200				1,800		
	21	Steamer Oregon		1,250			1,200	750				1,200		
	26	State of California											800	500
July	1	Columbia						350			200			
	6	Steamer Oregon	300										500	
	11	State of California					300	50		300			180	
	16	Columbia					1,000							
	21	Steamer Oregon					486	1,000						800
	26	State of California					2,000	156					550	
	31	Columbia		500	502			100					1,950	
Aug.	6	Steamer Oregon			1,000			150					1,700	
	10	State of California		500	1,500			100	500			1	1,162	
	15	Columbia			2,000			425					365	
	21	Steamer Oregon						1,400			5,000			
	25	State of California				200		625					137	
	30	Columbia			52	100	200	325						
Sept.	4	Oregon							109					
	9	State of California		575		337						50		
	14	Columbia							500					
	19	Oregon				1,000	200							
	24	State of California						200						
	29	Columbia										100	132	
Oct.	4	Oregon	481											
		Total	2,605	6,325	5,548	4,138	7,253	6,490	1,609	600	5,450	3,986	8,363	2,160

JUMPING OF SPANISH MACKEREL.—Mr. Barnet Phillips, while in the Gulf of Mexico, off west coast of Florida, 30 miles north of Tampa Bay, January 27, 1884, wrote:

"Last night a Spanish mackerel (*Cybium maculatum*), length 18 inches, jumped into the yawl-boat in tow." The captain says that often at night a half a dozen of these fishes are caught in the same way. I suppose the fish thinks the boat is an enemy and jumps to get out of its way.

Francisco, Cal., for the season of 1884–1885.

cases.]

whom.

West Coast Company.	Sam Elmore.	Aberdeen Company.	Ocean Company.	Point Adams Company.	Anglo-American Company.	White Star Company.	Badollet & Co.	Union Company.	Megler & Co.	Tillamook Company.	Warren & Co.	Columbia River Company.	W. T. Coleman & Co.	Knappton & Co.	Columbia Company.	Astoria Company Stencil.	Unspecified.	Total.	Total for the month.
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	581	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	70	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	208	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	326	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	400	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....		1, 645
370	25	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1, 900	
....	35	750	200	300	....	....	....	....	....	....	....	....	....	....	....	....	....	1, 367	
....	....	....	640	....	50	5	....	....	....	....	....	....	....	....	....	....	....	1, 635	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4, 595	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	600		9, 497
....	....	....	850	....	....	....	5	....	....	....	....	....	....	....	....	....	....	3, 050	
....	....	300	3	....	....	....	....	100	....	....	....	....	....	....	....	....	....	2, 055	
....	....	....	73	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1, 903	
....	....	200	200	....	....	....	55	....	1	5	....	....	....	....	....	....	....	2, 573	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4, 861	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1, 300	
....	....	....	200	....	500	....	....	100	....	....	....	....	....	....	....	....	....		15, 742
....	....	....	....	....	....	....	....	....	....	....	300	....	....	....	....	....	....	1, 350	
....	....	....	....	....	....	....	....	....	....	....	150	....	....	....	....	....	....	1, 100	
....	....	....	....	....	....	....	....	....	....	....	118	100	....	....	....	....	....	980	
....	....	500	....	....	....	....	1, 000	....	....	....	32	1, 000	....	....	....	....	....	1, 218	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4, 818	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2, 706	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3, 052	
....	....	....	....	....	....	....	....	175	....	....	....	1, 300	....	....	....	....	....		15, 224
....	....	500	500	....	....	....	....	225	....	....	....	....	....	....	....	....	....	4, 325	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4, 988	
....	....	....	....	240	....	....	....	350	....	....	....	1, 550	....	....	....	....	....	2, 790	
....	....	....	....	....	500	....	....	....	....	....	....	796	....	....	....	567	....	8, 540	
1, 300	....	....	900	1, 175	100	....	....	....	....	....	325	....	....	....	50	....	....	2, 825	
....	....	....	....	....	....	....	....	1, 075	....	....	....	....	....	....	....	....	....	4, 527	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....		27, 995
....	1, 100	....	....	....	....	....	....	....	....	....	....	....	100	291	....	....	....	1, 184	
....	500	....	1, 675	....	....	....	....	....	....	....	....	500	....	610	200	....	....	1, 353	
....	....	....	347	....	....	....	900	....	....	....	....	....	....	....	500	....	....	1, 800	
....	....	54	....	....	....	....	1, 000	....	....	....	....	192	....	....	....	....	....	4, 985	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1, 447	
....	....	....	....	....	....	....	153	....	....	....	....	....	....	....	....	....	....	1, 478	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....		12, 247
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	634	634
1, 670	1, 660	2, 304	5, 588	1, 715	1, 150	5	3, 113	2, 025	1	5	925	5, 438	100	991	750	567	600	....	82, 984

THE MENHADEN SEASON OF 1884.—Mr. W. Z. King, surveyor of customs at Greenport, Long Island, has reported, the quarter ending September 30, 1884, the number of menhaden taken to factories and rendered into oil and guano 117,000,000; number taken and used for manure, 5,000,000; total catch, 122,000,000; gallons of oil manufactured, 585,000; tons of soap (dry made), 81,000; of edible fish marketed, 230 tons. The number of sailing vessels is 201; of steam vessels, 29; total 230.

Memorandum of exports of salmon from Portland, Oreg., and upon wheat vessels, from August 25, 1883, to September 7, 1884.

[Compiled from the Portland Journal of Commerce of October 11, 1884.]

Flag.	Rig.	Vessel.	Destination.	Dispatched by.	Sailed.	Arrived out.	Quantity.	Average price per case.	Value.
					1883.	1884.	*Cases.*		
British	Bark	Kate F. Troop	Liverpool	Meyer, Wilson & Co	Aug. 25	Jan. 15	50,200	$4 60	$230,920
Do	do	Glenbervie	do	Sibson, Church & Co	Sept. 1	Jan. 18	21,837	5 00	109,185
Do	do	Chasca	London	do	Oct. 19	Mar. 9	11,467	5 00	57,330
Do	Ship	Griesdale	Liverpool	Balfour, Guthrie & Co	Nov. 3	Feb. 23	26,923	5 00	134,814
Do	do	Killochan	do	do	Dec. 17	Apr. 22	4,800	5 00	24,000
Do	Bark	Spirit of Dawn	do	C. Cæsar & Co	Dec. 15	Apr. 19	5,385	5 00	26,925
American	Ship	Ice King	London	Geo. W. Hume	Dec. 30	May 14	47,491	4 52	214,497
					1884.				
British	do	Eskdale	Liverpool	Balfour, Guthrie & Co	June 12		9,300	5 12	47,638
Do	Bark	Itata	do	C. Cæsar & Co	June 15		8,640	5 00	43,200
Do	Ship	Chs. Cotesworth	do	Meyer, Wilson & Co	June 19		13,658	5 00	68,290
Do	do	Aberyth Castle	do	Sibson, Church & Co	June 27		22,060	5 07	111,800
Do	Bark	Jessie Jameson	London	A. W. Berry	July 15		22,516	5 15	116,088
Do	do	Woodlark	Liverpool	Meyer, Wilson & Co	July 18		36,100	5 00	180,495
Do	Ship	City of Delhi	do	do	Aug. 6		48,820	4 96	241,800
American	do	Alameda	do	Sibson, Church & Co	Aug. 29		46,800	5 00	234,000
Do	Bark	Belle of Oregon	do	Meyer, Wilson & Co	Sept. 6		33,730	5 42	182,818
Total							409,727		2,023,830

OYSTER CULTURE IN NORTHERN MASSACHUSETTS.—Writing from Newburyport, Mass., December 4, 1884, Mr. James W. Gunnison states that, in connection with Mr. J. R. Dyer, two years ago he planted in the bed of the Parker River (a small stream flowing through Newburyport and entering into Plum Island Sound) some seed oysters taken from Buzzard's Bay. They survived the winter, and, being encouraged by this, 200 bushels more were planted last spring with the expectation that they would propagate during the summer. A few young oysters are now found, which are called this year's growth, but the territory is small and the tide swift, which has led the experimenters to think that much of the spat floated beyond their limits. The river bed is covered with water at all times of tide, and is navigable. The town authorities issued a license to Mr. Dyer to use the small tract in question, but the greater part of the river bed is leased to another person who has made no experiments.

STAR-FISH DEPREDATIONS.—The oyster beds, covering several hundred acres, off Milford and New Haven Harbors, have suffered seriously this summer from the depredations of star-fish. One Milford firm engaged in oyster-growing has employed a submarine diver to investigate their movements. It is proposed to gather the star-fish in purse-nets and carry them ashore for use as fertilizers. Many of the oystermen east of Bridgeport will put out but few shells this season on account of the bad prospect. The star-fish are less numerous at the west end of the sound, and more shells will be planted off Stamford, Greenwich, Norwalk, and Westport.

The large increase in star-fish is explained by some as due to the absence of menhaden, which used to swarm in the sound, and, as is alleged, devour star-fish spawn. The menhaden schools, which formerly covered thousands of acres, as well as the herring and alewives, which were numerous, and all considered as enemies of star-fish, have been caught up by the fishermen for oil, and are now rarely seen in the Sound.

The method of attack is thus described by Capt. S. J. Martin, under date of July 17, 1884: "Holding the oyster firmly as in a vise, the star-fish waits till the bivalve becomes hungry and attempts to open its shell to obtain the food. At this instant a reddish fluid, familiar to those who have caught star-fish at the sea-side in summer and experienced the irritation which contact with it produces on the hands, is injected between the shells of the victim, stupefying and rendering it an easy prey."

DIAMOND-BACKED TERRAPIN.—Writing under date of October 4, 1884, Dr. T. H. Parramore, of Hampton, Va., states that the diamond-backed terrapins are diminishing in that region, and he thinks that unless something is done to protect the species and to propagate it this terrapin will soon be exterminated. He will, therefore, devote some attention to the study of this subject. Professor Baird suggests in

reply that artificial culture in the fullest sense would be difficult, but that it is entirely practicable to collect the young whenever they can be had, and by feeding, rear them to a suitable market size.

FOOD OF MUSKRATS.—Mr. Charles Carpenter, of Kelley's Island, Ohio, who has already been quoted on this subject, (Bull. F. C., 1884, p. 295), writes under date of October 31, 1884, to say that he has learned from Mrs. Dr. McMeans, who has charge of Jay Cooke's residence at Put-in-Bay, that she has lost many chickens this season by the depredations of muskrats, as investigation showed. Mr. E. Alvord, fish-dealer in Sandusky, Ohio, stated that he also had lost chickens by the same means, and often. An old rat-trapper said, "They eat a great variety of food—indeed, they will eat almost everything."

WHAT FISH SOMETIMES SWALLOW.—Having seen the allusion to cod-fish swallowing knives and cards (F. C. Bull., 1884, p. 175), Mr. Henry Ffennell, of the Land and Water office, 2 Salisbury court, Fleet street, London, E. C., under date of September 23, 1884, writes: "I have before me a pewter flask which was presented to my father, the late Mr. Ffennell, commissioner of fisheries. On the flask is the following inscription: 'This flask, containing *two glasses of an ardent spirit*, was found in the stomach of a ling (*Molva vulgaris*), taken off Brandon Head, County Kerry (Ireland), presented by G. J. E. Stopford, esq., LL.D., and W. Andrews, esq., to W. J. Ffennell, esq., in testimony of esteem and of the sense of the services rendered by him as commissioner of fisheries.' The flask is round in shape, and when full holds just four wine glasses. From its appearance it is supposed to have belonged to a Dutch sailor. Although I know many instances of strange things having been taken from the stomachs of fish, I have never heard of so curious a case as this."

A SEA-MONSTER.—Mr. Alfred Morris wrote from Sidney, N. S. W., August 4, 1884, an account which appeared in Nature of September 25, 1884. He says: "Capt. W. Hopkins, of the schooner Mary Ogilvie, who has just returned from a voyage round Australia, has given the following information in order that other travellers may study the character of the animal, which, if an octopus, must be of much larger dimensions than those usually met with:

"On June 15, when in south latitude 21° 37′, and east longitude 113° 49′, about 5 miles off the Exmouth Gulf, on the western coast of the continent, he saw an immense creature which he took to be a species of octopus. His attention was drawn to it by a perfect cloud of sea-birds, and at first he naturally thought it must be a dead carcass. On approaching it, however, he found it was alive, and sluggishly disporting itself. In shape it was like a violin, but of immense size, with some six feelers about the greater diameters of the violin. It lay almost flat upon the water, was of a dark gray above and lighter gray below, and was

continually elevating one of its feelers, apparently twice the thickness of a man's arm, to a height of from 6 to 8 feet. It appeared to be vomiting, and as the birds were evidently feeding that accounted for their presence in such numbers. Its size was so great that, had it grasped the vessel, it could easily have capsized it. The captain, therefore, got out of the way as quickly as possible, and without making definite measurements; but a large whale in the vicinity looked quite diminutive. It is a pity that something more exact as to size is not available, but the description is sufficient to convey an idea of the nature of the monster. All along the northern and western coasts of the continent vast shoals of pumice, in portions varying in size from ordinary gravel to about a foot in diameter, and completely covered with barnacles, were passed through."

To prevent fish from reddening.—Writing from Gloucester under date of September 30, 1884, Mr. A. Howard Clark states that the boneless fish packers at Gloucester are using a preparation called preservaline in order to prevent the fish from turning red. With an ordinary dredging box the powder is sprinkled over the layers of boneless salt cod as they are packed in the box, about one pound being used for 35 pounds of fish. Fish thus prepared are warranted not to turn red even in the warmest weather.

Two 5-pound boxes of bank cod were put up several weeks previously and allowed to lie in a place favorable for reddening. The fish in the box containing no preservaline turned almost entirely red, while those in the box sprinkled with preservaline were clear and sweet. This was regarded as a pretty good test of the value of the powder. The substance, together with the labor of using it, costs from one-half to three-fourths of a cent per pound, and this has thus far prevented its general use on large lots of whole fish in the butts or on the flakes. It was introduced about a year ago. Another preparation is somewhat in use, which consists of a liquid, into which the fish are dipped.

The so-called preservaline has been analyzed under the direction of the United States Fish Commission and found to contain borax and common salt.

Fish for England.—Under date of September 20, 1884, Mr. W. Oldham Chambers, secretary of the National Fish-Culture Association, wrote from the exhibition grounds at South Kensington, London, and stated: "It has been decided by the most honorable the Marquis of Exeter, Mr. Edward Birkbeck, M. P., and the members of the council of this association, to take measures to introduce for the purpose of acclimatization special food-fishes from foreign countries. With this object in view we have dispatched to the United States Mr. William T. Silk, who has been commissioned to bring over to Great Britain in suitable carriers, with which he is provided, specimens of fish indigenous to your country, viz: Black-bass, whitefish, catfish, sheepshead, gar-fish, sun-fish, &c. Accordingly, on the 13th of October, 1884, there were de-

livered from the United States Carp Ponds to Mr. Silk 100 leather carp, 100 mirror carp, 20 blue carp, and 10 *Idus auratus*.

On the 25th of November, 1881, Mr. Silk wrote from Stamford, England, transmitting the thanks of the Marquis of Exeter, president of the National Fish-Cultural Association, for the different kinds of carp.

ENGLISH, LATIN, AND GERMAN NAMES OF EDIBLE BRITISH FISHES AND MOLLUSKS.—The following list is copied from the Second Annual Report of the Fishery Board of Scotland:

List of edible British fishes.

English.	Latin.	German.
Anchovy	Engraulis encrasicolus	Sardelle.
Angler	Lophius piscatorius	Seeteufel.
Atherine	Atherina presbyter	
Barbel	Barbus vulgaris	Barbe.
Bass	Labrax lupus	Sandart, zander.
Boarfish	Capros aper	
Bogue=ox-eye	Box vulgaris	
Bream, fresh-water	Abramis brama	Brassen, brachsen.
Bream, rays	Brama Raii	Castanuae.
Bream, sea	Pagellus centrodontus	Blei.
Brill	Rhombus lævis	
Carp	Cyprinus carpio	Karpfe.
Char, Alpine	Salmo alpinus	
Char, American	Salmo fontinalis	
Char, Willughby's	Salmo Willughbii	
Chub	Leuciscus cephalus	Kaulbörs.
Coal-fish	Gadus virens	Köhler, kohlfisch.
Coal-fish, young=Saithe	Gadus virens	Grundoroch.
Cod	Gadus Morrhua	Kabeljau.
Comber	Serranus cabrilla	
Conger-eel	Conger vulgaris	Meeraal.
Coregonus	Coregonus oxyrhynchus	Schnepel.
Crucian carp	Carassius vulgaris	Karausche.
Dab	Hippoglossoides limandoides	Butte.
Dab, pole	Pleuronectes cynoglossus	
Dab, smear	Pleuronectes microcephalus	
Dace	Leuciscus vulgaris	Weisfisch, lauben.
Dentex	Dentex vulgaris	Zahnbrasse.
Eel	Anguilla vulgaris	Aal.
Eelpout	Gadus lota	Quappe.
Flounder	Platessa flesus	Thorbutte, flunder.
Forkbeard, greater	Phycis blennioides	
Gar-fish	Belone vulgaris	Hornhecht.
Gilthead	Pagrus auratus	Goldbrassen, goldfohre, goldforelle.
Grayling	Thymallus vulgaris	Gräsling.
Gudgeon	Gobio fluviatilis	Gründling.
Gurnard=Gurnet butterfly	Trigla hirundo	Seeschwalbe.
Gurnard, gray	Trigla gurnardus	Knurrhahn.
Gurnard, lanthorn	Trigla obscura	
Gurnard, red	Trigla cuculus	
Gurnard, streaked	Trigla lineata	
Gwinead	Coregonus clupeoides	Renken.
Haddock	Gadus æglefinus	Schellfisch.
Hake	Merluccius vulgaris	Rothange.
Halibut	Hippoglossus vulgaris	Heilbutte, hellbutte.
Herring	Clupea harengus	Häring.
John Dory	Zeus faber	S. Petersfisch, sonnenfisch.
Lamprey, fresh-water	Petromyzon fluviatilis	Pricke.
Lamprey, sea	Petromyzon marinus	Lamprete.
Ling	Lota molva	Leng, langling, langfisch.
Loach or groundling	Nemacheilus barbatus	Schmerle, schmerling.
Loach, spined	Cobitis tænia	Steinpitzger.
Lump fish=lumpsucker	Cyclopterus lumpus	Lump, seehase.
Mackerel	Scomber scomber	Makrele
Mackerel, horse=scad	Caranx trachurus	Stachelmakrele.
Mackerel, Spanish	Scomber colias	
Mullet, gray	Mugil capito	Riesenbarbe.
Mullet, red	Mullus surmuletus	Rothbart, meerbarbe.
Old wife	Cantharus lineatus	
Opah	Lampris luna	
Perch	Perca fluviatilis	Barsch, börs.
Perch, dusky	Serranus gigas	
Pike	Esox lucius	Hecht.
Pilchard	Clupea pilchardus	Pilchard.

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List of edible British fishes—Continued.

English.	Latin.	German.
Plaice	Platessa vulgaris	Plattfisch, goldbutte.
Pollack	Gadus pollachius	
Pollan	Coregonus pollan	
Roach	Leuciscus rutilus	Roche.
Rockling, five-bearded	Motella mustela	
Rockling, three-bearded	Motella vulgaris	Seequappe.
Ruff=pope	Acerina vulgaris	Goldbörs.
Salmon	Salmo salar	Salm, lachs.
Salmon, severn	Salmo cambricus	
Salmon trout	Salmo trutta	Lachsforelle.
Sand-eel	Ammodytes tobianus	Sandaal.
Sand-launce	Ammodytes lancea	
Sardine	Clupea pilchardus	Sardine.
Sciaena	Sciaena aquila	Adlersfisch.
Shad=allis	Clupea alosa	Alose, maifisch.
Shad=twaite	Clupea finta	
Skate	Raia batis, R. maculatus	Meerroche, mairoche.
Sole	Solea vulgaris	Meersohle.
Sole, lemon	Solea aurantiaca	
Sole, variegated	Solea variegata	
Sparling=smelt	Osmerus eperlanus	Stint, seestint.
Spratt	Clupea sprattus	Sprotte.
Stone-basse	Polyprion cernium	
Sturgeon	Acipenser sturio	Stör.
Sword-fish	Xiphias gladius	Schwertfisch.
Tench	Tinca vulgaris	Schlei.
Thornback	Raia clavata	Dornroche, stachelroche.
Torsk	Brosmius vulgaris	Dorsch.
Trout	Salmo fario	Forelle.
Trout, loch leven	Salmo levenensis	
Tunny	Thynnus vulgaris	Thunfisch.
Turbot	Rhombus maximus	Steinbutte.
Vendace	Coregonus vandesius	
Weaver=wyvern	Trachinus draco, Trachinus vipera	Petermännchen, n. seedrache.
Whiting	Gadus merlangus	Weisling.
Whiting-pout	Gadus luscus	Breiter schellfisch.
Wolf-fish	Anarrhichas lupus	Seewolf
Wrasse	Labrus maculatus	Meerschlie.

List of edible British mollusks and shell fish.

English.	Latin.	German.
Clam	Hippopus maculatus	Hufmuschel.
Cockle	Cardium edule	Strahlmuschel.
Cuttle-fish	Sepia officinalis	Tintenfisch.
Crab	Cancer pagurus	Taschenkrebs.
Cray-fish	Astacus torrentium	Flusskrebs.
Lobster	Homarus vulgaris	Hummer.
Lobster, Norway	Nephrops Norvegicus	
Lobster, Spiny	Palinurus vulgaris	Languste.
Limpet	Patella vulgaris	Napfschnecke.
Oyster	Ostrea edulis	Auster.
Periwinkle	Littorina littorea	Herzmuschel.
Prawn	Palæmon serratus	Garnele, seegarnele.
Shrimp	Crangon vulgaris	Garnate.
Scallop	Pecten maximus	Jakobsmuschel, kammmuschel.
Whelk	Buccinum undatum	Trompeten schnecke.

REPORT ON SCHOODIC SALMON SENT TO SCOTLAND.—Sir James Gibson Maitland makes the following report upon eggs of Schoodic salmon sent him in March, 1884. He writes under date of September 6: "The Schoodic salmon have done remarkably well, and will shortly be transferred to a large pond. The young are now large enough to en-

able me to determine their species. They are undoubtedly a charr (*salvelinus*). The vomerine teeth being absent, they will undoubtedly improve our British charrs, but I fear the cross with *S. salar* will be sterile.

1. Number of boxes received, one.
2. Date of receipt (day and hour), March 19, 1884, 9 a. m.
3. Day and hour of unpacking, March 19, 1884, 9.30 a. m.
4. Number of eggs received, 5,000.
5. General condition on unpacking, good.
6. Number of eggs dead on unpacking, 25.
7. Number of eggs that died from time to time before hatching, 30.
8. Date of hatching, April 7.
9. Number that died after hatching, 139.
10. Temperature of water used for hatching, 44°.5 F.
11. Number of young fish lost in transportation, none.
12. A shipment of young fish was made from the hatching-house, as follows:
    - A. Date, June 24.
    - B. Number of fish taken, 4,800.
    - C. Lost on journey, none.
    - D. Time on the way, half an hour.
    - E. Number actually planted, 4,800.
    - F. Waters stocked (lake, pond, or large river), No. 2 plank pond.
    - G. In what tributaries, if any, they were placed, none.
    - H. In or near what village, city, or town, Howietoun fishery, Stirling.
    - I. In what county and State, Scotland.
13. Anything unusual in hatching or rearing? No.

"You will be glad to hear that the cross between *S. fontinalis* and the Loch Kannoch charr, *S. struanensis*, which I made three years ago, will prove fertile. The milt in a male, examined by Mr. Day (the product of *S. fontinalis* female and *S. struanensis* male), this week being fully developed and the most beautiful hybrid I have yet produced. A cross between *S. levenensis* female and *S. fontinalis* male also shows unmistakable signs of fertility.

"I propose to ship 100,000 *S. levenensis* ova the week commencing November 24. These eggs differ from the *fontinalis* in requiring a much larger supply of water, and it is absolutely necessary they should in no case be laid down so as to lie one above another. The water over them should not be more than half an inch, with a supply of two gallons a minute; size of trough, 7 feet by 20 inches. They will asphyxiate in 6 inches of water; temperature, 45° F.; date, a week before hatching. *Fontinalis* ova under the same circumstances hatch perfectly. This was a test experiment, and has been repeated with the same results seven years running."

A SCOTCH VIEW OF OUR METHODS.—The great superiority of the exhibit made by the United States Fish Commission at the International Fisheries Exhibition held in London in 1883, and the profound impression which the explanations of its methods and purposes of fish-culture produced upon European fish-culturists, induced the Scottish fishery board to send to the United States Prof. J. Cossar Ewart, one of its members, for the purpose of becoming practically acquainted with the systems in use in this country.

Professor Ewart succeeded Sir Wyville Thompson, the scientific head of the Challenger expedition, as professor of zoology in the University of Edinburgh, and is himself highly distinguished as an investigator. Every facility was afforded Professor Ewart in the examination of the various stations of the United States Fish Commission, and the following letter was written by him just before leaving New York to return to Edinburgh. He expects to revisit the United States next year in time to study the operations in the hatching of shad and fresh-water herring.

Under date of New York, November 5, 1884, writing to Professor Baird, he says:

"I have just returned from visiting all the stations you suggested, with the exception of Northville. I feel very grateful for the facilities given me to study the work of the Fish Commission. From what I have seen I am convinced that Scotland in doing her little has done best to follow in your footsteps, and that although your Commission has accomplished much already it is in reality only beginning its work, a work which will be of immense national importance. There is no doubt that fish-culture has a splendid future if carried on, as it has been by your Commission, in a truly scientific spirit. When I saw Wood's Holl, with its great facilities, I felt that I might confidently return to Scotland and advise the board of fisheries to devote all the means at its disposal to improving by artificial means the sea fisheries. I am extremely grateful for your kindness, and for the courtesy extended to me by all the officers of the Commission and others it has been my privilege to meet."

THE HOWIETOUN HATCHERY IN SCOTLAND.—One of the most successful private fish-cultural establishments in Great Britain is that known as the "Howietoun Fishery," and owned by Sir James Gibson Maitland, of Stirling, Scotland. At the International Fisheries Exhibition in Edinburgh, in 1882, he received a gold medal for fish-cultural apparatus and a silver medal for live salmonidæ. The *Société d' Acclimatation* of Paris has also awarded him its gold medal.

Upwards of 10,000,000 of trout ova are now annually incubated at the hatchery. Last year 90,000 yearling trout were delivered to all parts of Great Britain and Ireland. Two consignments of trout ova and one of salmon ova were forwarded to New Zealand successfully. Yearlings are recommended to its customers as the size for general purposes. They are

strong enough to find their own food, thus avoiding the principal cause of mortality among fry, namely, starvation. They are easily carried, and stand a journey well; they accommodate themselves with the greatest facility to new water, and they thrive fast in ponds. Two-year-olds are recommended where coarse fish or large trout already exist in the water. No difficulty has been found in carrying the trout in ice-water for any journey not exceeding twenty hours, but the water into which the trout are to be introduced must be of the same temperature in order to prevent inflammation of the gills. Accordingly the fish are forwarded only in cold weather. They are sent by express passenger trains in tanks of two sizes: 40 gallons weighing between 500 and 600 pounds, and 18 gallons weighing about 150 pounds. The following table will give an approximate idea of the prices charged for fry, yearlings, and two-year-olds:

Table of prices of trout and trout eggs at the Howietoun fishery, Scotland.

Kinds of trout propagated.	Partially-eyed ova—November to February.			Fry—February to April.		Yearlings, 2½ to 5 inches—January to March.		Two-year-olds, 5 to 8 inches long—December to February.	
	For 1,000.	For 15,000.	For 100,000.	For 1,000.	For 5,000.	For 100.	For 1,000.	For 100.	For 1,000.
Salmo levenensis (Lochleven trout)	$5	$35	$216	$10	$24	$10	$48	$24	$122
Salmo fario (common trout)	5	35	216	10	24	10	48	24	122
Salmo fontinalis (American brook trout)	5½	48	288	14½	35	12	72	31	192

SHIPMENT OF CATFISH TO BELGIUM.—The correspondence between the United States Fish Commission and the Government of Belgium has been several times alluded to in this Bulletin (1881, I, p. 340; 1882, II, p. 153; 1883, III, pp. 220, 437). On Saturday, November 15, 1884, the steamship Rhineland, of the Red Star Line, took from New York 100 live catfish (*Amiurus nebulosus*) consigned to Alfred Lefebvre, Ghent, Belgium. Messrs. Peter Wright & Sons, the agents, kindly furnished free passage, and instructed the officers to observe the directions for their care which were communicated by Prof. H. J. Rice, of the Fulton Market laboratory. Mr. E. G. Blackford arranged for the purchase of the fish and delivered them on board.

Under date of November 28, 1884, Monsieur E. Willequet, writing from Ghent, Belgium, announces the safe arrival of 95 of the live catfish, only 5 having died during the voyage. The 95 were safely transferred to the botanical garden of Ghent, and placed in quarters favorable for their multiplication.

FISHING IN THE BLACK SEA.—Mr. George Lambert Lehrs, an American citizen residing at Kadikovka, near Balaclava, on the Crimea, Russia, writes under date of November 6, 1884:

"The methods practiced in Balaclava for catching fish are very much

behind those in use in the United States. Trawling and drift-net fishing are not at all known, and the only way in which mackerel are caught is by a sort of trap made of netting and set up on piles. It works very well if the fish come into the trap, but sometimes they just pass by it. Fishing is confined to the bay and to certain seasons, at which time the fishermen are all on the alert, and various kinds of fish are caught. The consequence is that there are times when the market is glutted and other times when the supply is far short of the demand.

"If there were some way of catching the fish, especially mackerel, by going out to sea and fishing greater part of the year, the proceeds would always bring a remunerative price and the market be steadied. Mackerel are sold both fresh and salt."

RECEIPT OF PARADISE FISH FROM GERMANY.—Under date of November 11, 1884, Mr. Paul Matte, a fish-culturist of Bremerhaven, Prussia, wrote that he had just sent a consignment of *Macropodus venustus*, paradise fish. He is a member of the German Fishery Association, and engaged in raising ornamental fish for aquaria, which he imports from all parts of the world. He says, "I have recently introduced from Yokohama the first vail-tails (*Schleierschwänze*) ever brought to Europe."

The paradise fish arrived at New York via steamer Werra, on or about November 26, and were taken charge of at the dock of the North German Lloyd Steamship Company by Mr. E. G. Blackford, who took the best of care of them, and forwarded them to Washington, November 28. Of the 12 fish sent over but 5 reached Mr. Blackford alive. Immediately upon reaching Washington the fish were placed in a tank at the Central Station, but 2 died on the 6th of December, and the others on the 8th and 9th of that month. They were in feeble condition when received, and subsequently became completely covered with fungus.

SCARCITY OF MENHADEN, SEA-TROUT, AND SKIP-JACK OFF COAST OF SOUTH CAROLINA.—Writing from Waverly Mills, S. C., September 24, 1884, Mr. W. St. J. Mazyck says:

"For several seasons I have reported the visits of the menhaden to this coast off Pawley Island, 15 miles north of Georgetown Height. The past summer I have seen very few schools, and fish of all kinds have been scarce. The coral banks, 2 or 3 miles from our beach, usually give us all the fish we need, and commonly repay us for our trouble; we have lately found it almost useless to go to them, and just now, when trout and skip-jack should be plenty, we get none."

November 18, 1884, he again writes:

"Later in September we were visited by easterly winds, when a large number of crevalle were observed and some taken. About the 1st of October the winds were more southerly. Large schools of menhaden appeared and remained on the coast for a week. They were close under the shore in the surf. They then disappeared. In October we usually take a large number of skip-jack and sea-trout, but these were also scarce.

The sea or red bass were particularly so. Very few were caught during the summer. Whiting were also scarce. In fact, it was one of the poorest seasons I have known in eighteen years. We had a fairly good supply of shrimp."

FISH FACTORIES ON DELAWARE BAY OFFENSIVE.—A petition was received by the United States Fish Commission December 4, 1884, signed by twenty-nine fishermen and citizens of Lewes, Del., reading as follows:

"Knowing the interest which our Government, during the entire century of its existence, has taken in the coast fisheries, as well as the care and expense with which it is now guarding that industry, we presume to address you on a subject which is of vital importance to us as fishermen and citizens of the town of Lewes. Less than two years ago license was granted by the town commissioners to establish fish factories on the bay. We say little of the means by which this license was obtained. Our people were deceived. The fishing interest of the place, which amounts to from $8,000 to $10,000 annually, was entirely destroyed, and even the air we breathe was bartered away. In this distress we ask your aid. We ask you to remove from our shore that which is depriving us of our means of subsistence."

HABITS OF ALEWIVES.—Under date of July 26, 1884, Mr. E. M. Stilwell, one of the Maine fish commissioners, inquired:

Do the alewives spawn more than once? Do they visit our river, the Penobscot, to spawn, and then return to the ocean to die? There is an important case now before me where the alewives ascend the river through a good fishway; when they return, after casting their spawn, the water is low; the fishway is closed, owing to the factory using the water, and the fish return to the ocean through the flume of the factory and get ground up in the machinery. If the alewives born in the river return to spawn but once, the fact constitutes a very important point in the case before me."

Under date of August 6, 1884, Professor Baird replied as follows:

"It is impossible to answer satisfactorily your inquiry in regard to the habits of the alewife. We know, of course, that they spawn in fresh and perhaps slightly brackish waters, and that the young return to the sea. We also know that the adults do likewise, but whether they come back again the second time it is difficult to say. My own guess is that they do, and so far as we know, most of our fishes spawn for several successive years, as the trout, the salmon, the carp, &c. We infer that the shad does the same, from the fact that very few dead fish are found floating in the rivers or lying on the shores and in the bay. The fish are known to run out of the Saint John's River in the summer, and to fatten up in the flats at the head of the bay, when they become even better than they are in the early spring. Where shad are undisturbed for a long time we find them of enormous size, up to 10 and 12 pounds; thus showing that they continue to grow for a long period.

"I think if alewives died after spawning the fact would be noticed before they leave the rivers. When they get back to the ocean they have every opportunity, by abundance of suitable food and other favorable conditions, to recover their waste of flesh."

NOTE ON THE HERRING FISHERIES OF GREAT BRITAIN.—Writing from 10 The Crescent, Chapel Field, Norwich, November 20, 1884, Mr. Thomas Southwell says:

"The herring fishery here, which is rapidly coming to a close, has been remarkable for the immense catches, but the quality of the fish, as a rule, has been poor and the prices so low as to be hardly remunerative. I was at the Peterhead in August in the midst of the Scotch herring fishery and heard the same complaints as to quality. The whale and seal fisheries have been on the whole successful, and of this as well as of the herring I hope to send further particulars."

MOVEMENTS OF A SCHOOL OF HERRING.—Writing under date of August 26, 1884, Rev. Henry T. Cheever states that on the quiet evening of the 6th of August there occurred a phenomenon in York River never before seen by that traditional personage, the oldest inhabitant. At about half tide, between 8 and 9 at night, there came rushing from the ocean, as though in mad panic, a prodigious school of herring, reckoned at many millions. The sound they made was like that of water rolling over stones or shallows, or of a strong wind stirring the tops of trees. Visitors and people at a little distance from the river side thought at first by the noise that a notable dam had given way and that its pond was breaking loose. But on reaching the shore, behold, innumerable shining fishes leaping up into the moonlight, crowding the channel, dashing against the piers, striking and jostling one another; cleaving the flood and plunging into the mud on the bottom; flirting into boats that were out on the river, and capering every way in a most extraordinary manner as if on a lark or a fright or frenzy, one could not tell which. Many were seen to fall back into the water and sink, but millions followed on continuing for 6 or 7 miles with the inflowing tide, passing under three bridges, covering all the coves and marshes and leaving their dead in countless numbers caught and stranded by the returning tide or sunk in deep water.

In the morning the river flats, rocks, and marshes were piled with countless thousands, that looked from a distance like a shining pavement of silver or of white stones. Whether any appreciable number swam back to the ocean seems to be unknown, and the cause of their dying so largely is also in doubt. Was it from panic and fright by pursuing dogfish, that hideous monster of the deep? Was it from panting and suffocation (if asphyxia be possible to fish when in their native element) by being crowded in such numbers in the river channel and flats, when they had been used to the roomy breadth of the deep sea? Was it from concussion in the coast waters by late torpedoes

and dynamite? Or were they smitten with an epidemic or plague from the sewage of cities turned into the sea? Or did any noxious gases evolved in connection with earthquake commotions have to do with this remarkable phenomenon?

The farmers gathered them for manure to put on their lands, but millions were left to rot in the sunlight, and to exhale their pestiferous odors in the surrounding atmosphere. Had there been an oil mill in the vicinity one may think a small fortune might have been realized by at once collecting and grinding them up for oil and fertilizers.

SUNSET COTTAGE, YORK, ME., *August* 26, 1884.

HERRING AND MACKEREL EATEN BY SQUID.—Writing from Gurnett Life-Saving Station, Plymouth, Mass., November 15, 1884, the keeper, Mr. John F. Holmes, states that during the last three or four weeks large schools of squid and small herring, locally known as spirling, have frequented the waters of that vicinity, and quite often during the night more or less have been thrown upon the beach. This includes both squid and herring, the herring predominating. Many of the herring were found bitten on the back at the point where the head joins the body, some of the heads being bitten entirely off, and 90 per cent. of them being bitten in about the same place. The squid are quite large, some of them measuring 26 inches from the end of the longest tentacle to the end of the tail. Recently, between 6 and 8 o'clock p. m., the water being very smooth, a large school of what was supposed to be spirling was seen close to the shore. Two men ran into the surf and kicked more or less specimens on the beach. These proved to be squid and spirling, each squid having a spirling grasped in its tentacles, and each having already gnawed a hole in the spirling. The beach, for a distance of 6 or 8 miles, has been strewn with these spirling for some time. More or less squid and some mackerel have been found among them. The spirling and mackerel had been bitten in the manner described in almost every instance. Upon examination some of the squid were found to have their suckers stuffed with minced herring.

Commenting upon the above, Captain Collins, under date of November 21, 1884, says:

"The facts are not entirely new to me, so far as the habits of the squid are concerned. It is not an uncommon thing to see squid attack capelin on the Grand Bank, and so extremely voracious are these animals that they have sometimes been caught on a jig while still clinging fast to a capelin which they held in their beak and arms. It would appear from this that they are in the habit, at least occasionally, of attacking a second small fish before they have eaten the first they caught.

"In former years, when I was engaged in the mackerel hook fishery in the Gulf of Saint Lawrence, squid sometimes—particularly towards evening—came alongside of the vessel with the mackerel, and I have

no doubt that they often attacked the latter; at least they would often fasten on to a mackerel that was being hauled in on a jig. This we were able to see, as the fish came to the water's surface, but we could, of course, only surmise what the squid might do deeper down, when they were out of our sight."

I notice in the Cape Ann Advertiser of yesterday, the following, which is corroborative of the above:

"The mackerel fleet, some fifteen sail, which hoped to intercept the mackerel schools along the Cape shore, as they came out of the Bay of Saint Lawrence, and thus secure late fares, have been disappointed, as the mackerel have been destroyed by the immense schools of squid which infest that shore."

May there not be in this a possible solution of the scarcity of mackerel some seasons as compared with other years immediately preceding?

ABUNDANCE OF SCALLOPS.—Mr. Elisha Slade, of Somerset, Mass., under date of December 12, 1884, sends the following note, which he regards of considerable local interest:

"During the autumn of 1884, scallops (*Pecten irradians*) were very abundant in this vicinity, and dredging was carried to greater extent than in any previous year. From information gathered at different times, from what I suppose to be reliable sources, about 40,000 bushels have been taken from the Taunton River and the head of Mount Hope Bay, into which Taunton River empties. Scallops have been plenty in former years, but nothing like this amount has been caught in any one season; at least I find no record nor tradition to compare with it. The greater part of the fishing was performed between September 20, and November 20."

HAKE IN NANTICOKE RIVER.—Mr. E. W. Humphreys, Maryland commissioner of fisheries, writing from Salisbury, December 6, 1884, says:

"Small hake, averaging in length 10 to 15 inches, have been taken in Nanticoke River during the last few weeks. Several hundred were caught in pound-nets by fishermen near Vienna, Dorchester County. The water has been quite salt well up the river on account of the extreme drought which prevailed during the summer and early fall. The fishermen say that the hake has never before been taken in the Maryland rivers."

NORWEGIAN HALIBUT FISHERIES.—Under date of Washington, November 27, 1884, Capt. J. W. Collins says:

"The following replies of Capt. Niels Juel, of Bergen, Norway, to inquiries I made relative to the occurrence of halibut in the waters of Northern Europe, particularly on the west coast of Norway, seem to be of special interest just now. The success of our fishermen last summer,

at Iceland, may induce them to extend their cruises into still more distant seas.

"Writing to Captain Juel, under date of October 16, 1884, I asked the following questions: (1.) 'Can you give me any information as to the abundance of halibut on the coast of Norway? (2.) When and where do they occur? (3.) Do the Norwegians make use of them for commercial purposes? (4.) Would the Norwegian Government permit American vessels to buy or catch halibut near its shores?'

"Of course I understand that foreign vessels can fish outside the limit, but I am interested to know if your people would be kindly disposed toward our fishermen if they came on your coasts?

"Under date of November 5, 1884, Captain Juel, says:

"'Halibut are found all along the coast of Norway, and in almost all the firths, and are fished for almost all the year round, but particularly in early summer, which is the spawning season. It does not give occasion to any particular fishery, but the halibut is taken with the ling, cod, and other fishes, by the shore fishermen. In some places they use particular lines on grounds where the halibut resort in greater numbers than ordinary. The fish is either salted in barrels or cut in strips and dried. Only smaller quantities are shipped in ice to England, particularly from Aalesund. The export from Bergen in 1883 was about 118,000 kilograms net (equal to 260,172 pounds). The salted and dried halibut is consumed in the country.

"'British fishermen are taking halibut during the months of May to July on the banks of Skagerack and the North Sea, 10 to 15 geographical miles south and southwest of the Norwegian coast. Round Iceland is also a very good halibut fishery during the summer.

"'All kinds of exports are reserved to the inhabitants, except that of fresh and salted fish, which is allowed to foreigners from June 15 to September 30, from several fishing places specially named by law in the counties of Nordland and Tromsö. If, for instance, foreigners wish to buy fish, they are obliged to use a commissioner, who can easily be procured. No fishery will be allowed within a distance of 6 geographical miles (minutes) from the coast; at least the Government tries to keep the 6-mile (1 Norwegian mile) limit; but we have no coast guard, and as coast fishing is not very much practiced in summer, except off Aalesund, foreigners will seldom interfere with our fishermen.'"

HALIBUT GETTING SCARCE.—The Boston Daily Advertiser of July 9, 1884, says:

"Halibut of late years are getting to be very scarce, and very few can now be found on our banks, where twenty years ago they were numerous. Our vessels have to hunt for new grounds, and fish in deep water to get any."

HALIBUT IN FRESH WATER.—One of Mr. Blackford's correspondents, Mr. N. W. Foster, of Riverhead, N. Y., says:

"In this village, near the dock last Saturday afternoon [November 15,

1884], one of our boys captured a halibut, weighing 65 pounds. I never heard before of their going into fresh water."

Riverhead is situated at the head of Little Peconic Bay, and the waters are shoal and not very salt near the village. The river is entirely fresh water, and falls over a mill dam not over 300 feet from the bay. The halibut was taken by a fifteen-year-old boy with an eel-spear, between the mill dam and the bay.

BLACKFISH EGGS IMPREGNATED.—Writing from Charleston, S. C., under date of March 25, 1880, Mr. R. E. Earll reported:

"This morning while at the fish-wharves I discovered that nearly all of the 'blackfish' (*Centropristris atrarius*) were thoroughly ripe, and eggs running from fully 50 per cent. of the females when handled. I took a number of thousand and impregnated them. They sink readily in salt water, and have a diameter of one twenty-seventh of an inch. I have saved some in alcohol and glycerine. Many of the other species are well advanced, and will spawn in two or three weeks at most. I shall try to get a full series of ovaries in alcohol for future examination."

CAPTURE OF BLACKFISH.—About 3 o'clock in the afternoon of Saturday, November 15, 1884, a school of blackfish (*Globiocephalus melas*), was announced at Provincetown, Mass., as being present in the bay. Immediately a large force of men, in sail and row boats, went in pursuit and captured some by the use of lances. One small section of the school was driven into shoal water and the fish captured. On the following morning a much augmented fleet went in pursuit and drove the fish across the bay to the shores of Dennis and Brewster, but without eluding them into shoal water. Fearing a total loss of the fish, the boats dashed into their midst about dark, and many of the largest and best were killed with case-knives. About 60 were thus taken. On Monday the pursuit was again renewed, and the fish were driven into Wellfleet Harbor, where 150 went ashore at Indian Neck, and were killed by the boatmen and inhabitants. Others were driven ashore at Blackfish Creek, making, in all, a capture of about 1,400 blackfish.

The carcasses were sold at auction for from $7 to $12 each, and will average a weight of 4,000 pounds apiece. There were a few young which weighed from 150 to 200 pounds each. The blubber is tried for the oil, and it is estimated that there will be $25,000 worth of oil. Most of them will be tried at the Cape Cod Oil Works of Cook & Co., Princetown, Mass. Some 450 persons engaged in the capture and will share the prize-money.

The foregoing account has been compiled from newspapers, while the following has been furnished by Mr. D. C. Stull, of Princetown, in a letter dated December 15, 1884:

"About noon on Saturday, November 15, 1884, blackfish were sighted about 4 miles southeast from Wood End, Provincetown. Boats chased them until midnight to drive them ashore. Owing to the presence of

sharp-nose porpoises among them they could not be driven ashore, for they would turn off just as soon as they struck shoal water. We had the fish almost ashore a number of times during the night, and we could have driven from 1,000 to 2,000 ashore if it had been daylight. On Sunday morning, November 16, the boats went to look for the fish and found them at night on Dennis shore, when they drove 64 of them ashore. On Monday morning boats came from Wellfleet and joined our boats and commenced to drive them toward Wellfleet. They succeeded in driving them into shoal water known as Blackfish Creek, South Wellfleet. Here the fish were completely hemmed in by land and shoal water. Then the fish commenced to go ashore, the boats going among them and lancing them. The men were engaged in killing them all Monday night and Tuesday. It was the largest amount of blackfish ever driven ashore here at any one time, the number being about 1,400, which was not half the number that was in the bay on Saturday. The fish were sold at public auction Wednesday, the 19th, to Provincetown parties, at an average of $10.21 apiece, the gross proceeds being between $14,000 and $15,000. This amount will be divided into 468 parts (the number of men and boats engaged in the catch), or about $30 each. The average yield of oil from each fish will be one barrel. The parties who purchased the fish have just finished boiling them for oil. They will be well paid for their time and trouble, as the oil which is extracted from the body of the fish is selling at from 55 to 60 cents per gallon, while that from the head of the fish is worth a good deal more. This is the first school of blackfish that has been seen here for a number of years."

NOTES ON THE RED SNAPPER.—Writing from Pensacola, Fla., November 26, 1884, Mr. Silas Stearns says:

"In any part of the northern Gulf of Mexico where there is a rock coral or gravel there is a certainty of there being red snappers. Sometimes there are kinds of food on shelly bottoms which attract the snappers. In the southern gulf groupers occur under the same circumstances. Forty fathoms is the deepest that we have searched, and there may be fishing grounds beyond that depth. The *Caulolatilus microps* is always present in 40 fathoms in about one locality, and sometimes a dozen or more are caught in one day.

"A few codfish nets were brought here from Boston and sent out on one of the smacks, but the fishermen did not understand hauling them and were indifferent as to their success, so that they were not fairly tested. This fall we have Capt. D. E. Collins, of Gloucester, and a full crew of experienced trawl fishermen to man the vessel, and we have material for nets on a fishing schooner now bound for this place.

"Capt. J. W. Collins, of the United States Fish Commission, has suggested trying the cod gill-nets on the red snapper grounds, and under date of December 2, says: 'Owing to the peculiar shape of red snap-

pers, deep and narrow, the capture in gill-nets might be facilitated by having the nets taken up a trifle more in the hanging. The 7 and 8 inch mesh cod gill-nets with which the Albatross is provided would, perhaps, be rather small for snappers, and I think two nets of the proper size mesh should be procured. They are now using in Gloucester a superior kind of twine, which, I am told, makes a more durable kind of net.'"

WHERE AND HOW THE RED SNAPPER IS CAUGHT.—In a recent circular Warren & Co., of Pensacola, Fla., say that this fish is one of the most common in the Gulf of Mexico. It is gorgeously colored, very graceful in all its movements, and unusually wary and capricious. In weight it ranges from 2 to 35 pounds, averaging 7 pounds. Its home is in the strictly salt waters of the gulf, a short distance from the coast. There it lives on the bottom at a depth of 60 to 240 feet. The ocean floor off Florida declines greatly at first, for a distance of from 30 to 50 miles from the shore, to a depth of 300 feet, then very abruptly descends to a depth of 600 feet, beyond which the slope is more gradual to a depth of about 12,000 feet. The first slope is a sandy one; the second is sandy, rocky and muddy, while the third is wholly muddy. The surface of the second, with its uneven rocks, afford homes and comparative security for all kinds of small marine animals, such as crabs, barnacles, corals, &c. These attract myriads of small fish, which are preyed upon in turn by larger, and so on upward.

The red snapper is most prominent in these communities. It is one of the largest and most active species. Its life is spent about the patches of rocks, swimming about 6 feet from the bottom among tall branching corals and waving grasses, forever on the alert to dash upon some smaller fish. Its whole appearance suggests craftiness, smartness, and conceit. Ordinarily it has about fifty species of beautifully delicate fishes to select its food from, and it seems to show considerable judgment in the selection. Among these are rare fishes that live only about the coral reefs of warm seas. Even that most celebrated little fish of the Romans—the red mullet—that was so highly esteemed by the epicurean emperors, furnishes an occasional meal for the red snapper. In consequence of living upon food of this character, the flesh of the red snapper is peculiarly firm and sweet, being disposed in regular layers that make it especially desirable for serving at the table.

The red snapper is caught altogether with hook and line. Vessels carrying 6 or 8 men go to sea prepared with all appliances for capture and preservation, and are about one week in securing what is termed a load. They go from home as far as 250 miles, being then about 50 miles from land. The places where the fish live are found by sounding-lines that indicate the depth known to the fisherman, and that have baited hooks attached which are quite sure to get a victim if there are fish near by and they are disposed to bite. The vessels are anchored over the spot or allowed to drift across it, while the fishermen ply their lines

as rapidly as possible. Each man handles a single line, which has two large hooks and several pounds of lead attached. When the fish are hungry they bite as fast as the lines are lowered to them and even rise near to the surface of the sea in their eagerness, biting at bare hooks or anything that is offered. From this habit they have gained the name of snappers. Very often two large fish are hooked at once, and then the fisherman has a hard pull, for the snapper is gamey. While it is so easily captured at times, there are spells when it cannot be lured by any kind of bait or snare. It is truly a capricious fish.

Storms, adverse winds, and currents affect the business of the fishermen very much, and at best theirs is a hard, disagreeable life.

The principal red-snapper fishing-grounds of the gulf lie between Mobile Bay and Cedar Key. This places Pensacola nearer to them than any other shipping point, and besides there is no other city so conveniently located for receiving and shipping the catch of the large fleet of vessels that are now engaged in the business.

HOW TO COOK THE RED SNAPPER.—Warren & Co. have also furnished receipts for cooking this fish in some half dozen different ways, viz:

BOILED.—Take a fish of 5 to 8 pounds, cut off head, wash clean in cold water, tie up tight in a clean cloth so that it will not break to pieces in the water. Put it in enough hot water to cover well, with half a cup of vinegar and a handful of salt; boil steadily for three-quarters of an hour, or until the flesh cleaves readily from the bone. Serve hot with this sauce. Take one pint of water, make a flour thickening, stir in the water, and let it boil till clear. Add salt to season, a little pepper, a tablespoonful of butter, and two hard-boiled eggs, sliced.

BAKED WITH DRESSING.—Take a fish of 5 to 8 pounds, wash it clean in cold water, leave on the head, and, in removing the entrails, see that no longer cut is made in the belly of the fish than is absolutely necessary to clean the cavity. Prepare a dressing as follows: Have ready enough stale bread to fill the cavity in the head and belly, soften it with cold water, take two tablepoonsfuls of lard in a sauce-pan, cut finely a medium-sized onion, put it in the lard and cook thoroughly, but not to brown; add to this the softened bread, mix well together and season to the taste with pepper, salt, and herbs; stuff the fish with this dressing and cook in a hot oven, having a little hot water in the bottom of the pan, dredging the fish with a very little flour. Cook until done, and serve hot.

BAKED WITH TOMATO DRESSING.—Prepare the fish as before. Make a dressing by soaking twice as much bread as above directed with the contents of a 2 pound can of tomatoes, or an equivalent quantity of fresh tomatoes, heat it thoroughly in a sauce-pan, season with salt and pepper, adding a tablespoonful of butter. Stuff the fish with this dressing; spread the remainder of the dressing over the outside of the fish, as it lies in the pan. Bake in a hot oven as before directed.

BROILED IN THE OVEN.—Take a fish of 3 to 5 pounds, split the fish through the backbone; put in a dripping pan two heaping tablespoonsful of butter, set on the top of the stove and let the butter get hot; lay in the fish, spread open, skin-side down, put salt and pepper on it and bake in a very hot oven, basting frequently with the butter. After placing the fish on a platter for the table, squeeze over it the juice of a lemon and serve without delay.

FRIED.—Cut the fish in pieces off the backbone, wash clean and dry with a towel, sprinkle on salt, and roll in corn meal. Fry in a pan, half full of lard, as hot as possible, and yet not hot enough to burn the fish.

COURT BOUILLON.—Use a fish of from 5 to 8 pounds weight. Take two teaspoonfuls coloring pepper, one-half teaspoonful black pepper, quarter teaspoonful cayenne pepper, two garlics cut in thin slices, put all in a tea-cup and pour cold water over them. Put in a kettle on the fire half cup of lard, let it get very hot, slice into this a medium sized onion and let it cook, stirring constantly. Add a half a can of tomatoes, or three ripe tomatoes, let it cook well together, then put in the fish, the mixture of pepper and garlic, sufficient salt to season, and a half a cup of flour. Stir well, then cover with boiling water, and let it boil ten minutes. Serve at once.

SALMON FROM NOVA SCOTIA, MASSACHUSETTS COAST, AND THE COLUMBIA RIVER IN NEW YORK MARKET.—Mr. E. G. Blackford, writing under date of November 25, 1884, says:

"We are having a singularly large amount of fresh salmon from Nova Scotia. During the last two weeks about 1,000 pounds have arrived in this city. They are all of about one size, that is, weighing from 7 to 9 pounds each. There are also occasional salmon coming to the market caught in the mackerel weirs off the Massachusetts coast. Some half dozen have arrived within a week. They sell in this market for 75 cents per pound.

"I am also receiving from the Columbia River very handsome specimens of the *Salmo gairdneri*, or, as Dr. Bean suspects, large California trout. They are selling at present for 35 cents a pound."

Writing again under date of December 2, Mr Blackford says:

"In regard to the salmon that are caught on the coast of Nova Scotia I would say that they are all clean-shaped fish. No hook-noses among them, but handsome, bright, and silver-white in color. I cannot ascertain the exact point where they were caught, as they are consigned to some party in Boston and are forwarded by them to this market. They average in weight about 8 pounds, and, so far as I can ascertain, about 1,500 pounds have been received in this city during the past twenty days.

"The salmon caught off the coast of Massachusetts are taken in the mackerel weirs, principally in the vicinity of Truro, but not in any large numbers. Altogether about twenty fish, averaging 7 pounds each, have been received in this market. They are also a clean, fresh-run fish."

STRIPED BASS IN TANGIPAHOA RIVER.—Under date of July 5, 1884, Mr. J. Dock. Harrell, of Osyka, Miss., forwarded a small fish for identification and stated that some of the same kind caught there weighed from 2 to 3 pounds each. In a subsequent letter dated July 16, he reported the same fish as becoming numerous and that since the forwarding of the specimen others of the same size had been caught and great schools of still smaller ones had been seen. At that date specimens weighing from 4 to 6 pounds each had been taken. The specimen was identified by Dr. Tarleton H. Bean as striped bass, *Roccus striatus*, who has reported upon this and another specimen received in April, 1883, from Mr. Thomas S. Doron, in Proceedings of the United States National Museum, 1884, page 242.

BITING HABITS OF THE BLACK CROSS-TOOTHED FISH (*Chiasmodus niger*).—Under date of July 30, 1884, Captain Collins transmits the following note upon a specimen presented to the United States Fish Commission in June last by Capt. George A. Johnston:

"When first seen by Captain Johnston the fish was swimming with its belly up at the surface of the water. It was going around in a circle at a great speed, and savagely biting itself just above its tail. When captured, Captain Johnston says that part of its body next its tail was more or less scarred with marks of its teeth. As the stomach of the fish was inflated at that time it may be that its attack on itself was a desperate attempt to relieve itself from the unnatural and uncomfortable position in which it was placed. However this may be, the fish exhibited the same peculiarity after being put in a bucket of water on the vessel's deck. It also bit viciously at the dory scoop in which Captain Johnston dipped it up from the water's surface. After being placed in a bucket its temper was tried by putting a piece of rope in front of it. This it fiercely attacked, sinking its teeth so far into the rope that there was some difficulty in separating the two without injuring the fish. Wishing to see what it might do after the air was let out of its stomach, Captain Johnston thrust a smooth round stick down its throat, but the moment the gas escaped the fish died."

ON THE DIMINUTION OF THE OCEAN FISHERIES.—The trawling commission of Great Britain, having its office at 6 Old Palace Yard, Westminster, with a view of ascertaining what, if any, effect the efforts of men, especially with the beam trawl net, have upon reducing the ocean fisheries, has addressed several questions to the leading countries of Europe and to the United States, from the replies to which the following data has been extracted:

Has the inshore fishing within 5 miles of low-water mark diminished of late years along the whole or any part of the coast, and if so, to what cause is it ascribed?

FRANCE.—No diminution has been noticed, but the amount of fish taken varies according to the seasons, some being better than others.

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The French Government makes no distinction between "coast" and "deep sea fishing;" herring and mackerel salting and cod-fishing excepted.

DENMARK.—There is no diminution on the "scaw" or on the west or east coasts. There is a diminution in the "sound" and some parts of the "Kattegat" where gar-fish, mackerel, and whiting have nearly disappeared, as have also to a great extent large cod, ray, halibut, and smeardab. In the deep channel running from Helsingborg, haddock have totally disappeared. The diminution is ascribed to the increase in the number of fishermen and natural causes resulting from changes of weather and stream and the abundance or dearth of food.

BELGIUM.—No general diminution has been noticeable, though at places of minor importance there has been a sensible diminution in the inshore herring fishery, the herring keeping further out to sea.

NORWAY.—There is no diminution in deep-sea fishing, though the fish disappear and reappear from time to time. There is a local diminution in the inshore fishing.

SWEDEN.—There is no general diminution, though the fish disappear and reappear from time to time.

HOLLAND.—Except in the Texel there has been a general diminution in the coast fishing, which has been attributed to the increase in fishermen, especially of trawlers, among whom are many Englishmen. The diminution is also attributed to the destruction of immature fish by the shrimp dredge-net, the mesh of which is very small.

GERMANY.—There has been a diminution in the "coast" fisheries of the North Sea, especially among flat-fish, cod, and halibut. The size of flat-fish has materially diminished during the last few years. This is attributed to the destruction of fry and immature fish by trawl-net fishing in the North Sea.

UNITED STATES.—On certain parts of the coast of the United States, particularly on the Atlantic coast between Eastport, Me., and the Chesapeake Bay, there has seemingly been some decrease of the abundance of certain species of food fishes, but the supply varies so much at the different seasons that it is difficult to make any precise statement. The halibut, however, is one species in which there has been a very remarkable diminution during the past thirty years, both inshore and on the outer banks. This appears to be due to the operation of man; for wherever sought the halibut have usually become scarce in a limited number of years on grounds where they had formerly existed in remarkable abundance. Cod and its allied species have in some instances become locally scarce from unknown causes.

Are fish generally taken in deeper water and at greater distances from

the land than formerly, and does the practice of fishing with the beam trawl net from steam and sailing vessels exist on any part of the coast?

FRANCE.—The beam trawl-net is used principally by sailing vessels, and almost without exception outside the 3-mile limit. Possibly engines of this nature have frightened the fish into deep water. Its use is forbidden within 3 miles of the shore with certain exceptions. The size of the mesh *must* be at least 25 millimeters square.

DENMARK.—The use of the English trawl is, by the law of March 9, 1872, forbidden within three-fourths mile of the shore. Very great injury has been done by miniature trawls in the firths. It is not thought that fish have been driven to deeper waters.

BELGIUM.—The beam trawl is used exclusively by sailing vessels and in various places in this country. The movements of the fish have not been observed to vary except according to the different seasons of the year. No restriction has been placed on the use of any apparatus.

NORWAY.—The beam trawl is not used.

SWEDEN.—The beam trawl is not used. The fish appear to have taken to deep water, which is possibly owing to the increase in the size or number of the implements which are in use.

HOLLAND.—The larger fish certainly keep at a greater distance from the land than formerly, probably owing to the change in the temperature of current. There is no restriction on the beam trawl-net except in the waters of the Zuyder Zee and Zeeland, and it is used by sailing vessels exclusively all along the coast of the North Sea.

GERMANY.—Trawling is forbidden near the State oyster beds and on certain coasts. The trawl is 20 feet beam, and is used by about 300 small sailing vessels along the Prussian coast.

UNITED STATES.—It is suspected that fishing has, in some cases, driven fish to deeper water, but this is not by any means a proven fact. It is highly probable that in certain years some kinds of fish have been kept away from the coast by low temperatures of water.

THE FISH OF INDIAN RIVER.—Writing from Tropic, Brevard County, Florida, under date of September 29, 1884, Mr. M. E. Stevens, says;

"The fish in Indian River are very fine, large in size, and delicious in in flavor. Just now we are enjoying the first of the mullet, the run not beginning till about the 1st of October; then they come through Indian River Inlet and pass up the Banana or East Indian River in such countless numbers as to be crowded on shore. These are taken by the tons and cured for winter use at home. Many tons are also being used for fertilizing purposes.

We also have bass, trout, pompano, Spanish mackerel, red snappers, and a medium-sized fish locally called snapper or mutton fish, fine flavor, and a most lovely looking fish, being striped from head to tail with narrow stripes of bright pink and blue on the sides and bright silver on the under side; smaller ones most beautiful in an aquarium.

"If Northern tourists only knew of the green turtles, oysters, and fish that abound in the beautiful Indian River all the year, they certainly would spend at least a few weeks of winter in some one of the many hotels or comfortable boarding-houses on the mainland or west shore or on Merritt's Island.

SUCCESS OF WHITE FISH PROPAGATION—MEETING OF FISH COMMISSIONERS AT MILWAUKEE, OCTOBER 17 AND 18.—Under date of Northville, Mich., November 11, 1884, Mr. F. N. Clark, has reported:

"There was a good attendance of commissioners, also of the leading fishermen. Many subjects of interest were discussed, though the proceedings were mostly informal.

"Although there was no formal expression relative to the work of the various commissioners, the feeling was most friendly to all and to their work. It was freely asserted on all hands that results were already apparent. There was no question as to the value of propagation; but in order to obtain the best results and to have the work receive the full credit to which it is justly entitled, it was necessary to adopt measures to prevent the wholesale capture of yearling whitefish now accredited to the herring catch.

"The time was when a majority of the men representing the capital employed in the fishing industry of the Great Lakes had little faith in propagation as a means of increasing or preventing a decrease in the supply; but these men are now our strongest friends. The catch of whitefish in Lake Erie last fall brought over those not already converted. Up to the time of the great storm of November 10 to 15, last year, the catch in that lake was greater than for several years, and this year promises to be even better; this is especially gratifying, as the result of our larger plantings could not fairly be called due until last year. Prior to four or five years ago the number of young whitefish planted in this lake did not equal the number of adult fish taken out. This is all in the face of excessive fishing all over the lake, but particularly at the west end. All around the islands, and from Sandusky around to the Detroit River and Canadian shore eastward, the catch had been already growing lighter, as the coast was literally lined with twine.

"Resolutions were passed instructing the commissioners to urge upon the legislatures of the Lake States the enactment of statutes regulating the size of mesh, so as to catch mature fish only, and the adoption of a close season for certain kinds of fish. All in all, the meeting was interesting and profitable, and will, I believe, result in a definite line of action being taken to adjust and regulate the fishing industry of the Great Lakes.

"Speaking for the people of the Northwest I can say that there is now but little opposition to our work on account of a belief that fish-culture, as applied to increasing the food supply of the Great Lakes, is a failure. Of course there is some antagonism to the work; not, how-

ever, on account of any question as to its abstract value, but because it is thought by many to savor of 'class legislation.' Some of this class are of those who are always opposed to anything and everything that calls for a dollar of the public funds, while there are others who honestly think that the cost of maintaining any industry should be borne by the industry itself.

"Our penning work at Monroe promises to be very successful. We now have upwards of 1,500 fish in crates, all doing well, and will put in a few hundred more.

"The young whitefish which we will send you from Northville have been reared on precisely the same food as our brook trout; viz, chopped beeves' or hog's liver. We feed them twice daily. Our success with these fish makes it safe to say that the whitefish can be made a pond fish in cold waters if raised from infancy in ponds or tanks."

GROWTH OF CALIFORNIA TROUT.—Mr. J. S. Delano, writing September 16, 1884, from Mount Vernon, Ohio, says:

"The 51 two-year-old California trout you kindly gave us last spring have done remarkably well, and the young fry from Northville have been a great success, too. I really think some of the two year-old are 18 inches in length, and we have not lost one.

"Our success has encouraged us to bring from a distance of 1,800 feet another supply of water, which was sufficient, this dry summer, to fill a 6-inch sewer tile, with a fall of about 1 foot in 200; the temperature 50°. This fall the 51 two-year-olds must be moved into the larger lake. The young fry, many of them now 5 inches long, must also be moved."

Mr. Emanuel H. Frantz, of Clear Spring, Washington County, Maryland, under date of August 6, 1883, says:

"Some California trout and landlocked salmon were sent to me, which I placed in the large dam. I saw one jumping up last week which surprised me. It was fully 20 or 24 inches long. They have been in the water over three years. The dam is over 10 feet high, and the backwater extends 150 yards, and is 65 yards wide."

SHAD IN GEORGIA WATERS.—Mr. Newton Simmons, writing under date of December 10, 1884, states that he had recently seen General Young, of Georgia, from whom he learned that the plant of shad made in recent years in the Woostanoula and Etowah Rivers has been a great success, and that a great many shad were taken out of these two rivers last spring and the year before.

Concerning the increase in shad in this State, due to propagation and the taking shad with bait in Chattahoochee River, Dr. H. H. Carey writes as follows in his report to the Commissioner of Agriculture for 1883 and 1884:

"In 1880, 1,000,000 shad fry were planted in the waters of Georgia, and in 1881, 1,800,000. This was the work of the United States Fish

Commission. In three years after the planting they returned to find their spawning-grounds. Of the planting of 1880, 400,000 were released in the Chattahoochee, at Iceville, near Atlanta. It was not expected that these fish could pass up further than Columbus till fishways were placed at the obstructions at that place. The fry constituting this plant were reported to me as being the Connecticut River shad. It is well-known that the Connecticut River shad will take the bait, and the sportsmen can find in the Northern markets tackle for shad fishing. The South Atlantic shad do not take the bait. True to their instincts, shad appeared in 1883 in the Chattahoochee River below Columbus, and were taken with the hook and bait. It is therefore reasonable to suppose that the fish thus taken were of the planting of Iceville in 1880. Of the 1,800,000 shad planted in 1881, 1,000,000 were released in the Ocmulgee at Macon. The fish, of course, were due on their return in the spring of the present year. I have recently visited Macon and made careful investigation in regard to the expected return of these fish, and I am pleased to say that I have not been disappointed. While there was no particular arrangement for catching shad—and hence the catch was light—still they must have appeared in large numbers, as a sporting gentleman informed me that full-grown shad were taken in considerable numbers, the fishermen standing on the bank of the stream and capturing them with the dip-net. I mention these facts to show with what facility a barren river can be impressed by liberal plantings of the shad fry."

SHAD IN OCTOBER.—Mr. E. G. Blackford, writing under date of October 31, 1884, says:

"I have to report the surprising fact that a large catch of shad has been taken off Truro, Mass.* I received quite a lot October 29, and have telegraphed for 300 more."

Under date of November 18, he adds:

"In reference to the shad that were in this market from the 5th to the 10th of November, our examination of them gave the following results: The stomachs of every specimen were empty, except in one instance, where a small quantity of gelatinous chyme was noted. The ovaries and spermaries were all small and immature. The largest specimen weighed 6 pounds, and the smallest 2 pounds. Their edible qualities were equal to any shad that are caught in the spring. One of our customers, Judge Shipman, expressed himself as believing that they were as good as any shad he ever ate. I can also bear personal testimony to their excellence, having tried one at a dinner party. Mr. C. R. Miller, editor of the New York Times, also expressed himself in the same terms."

* The ocean temperature at Race Point, just north of Truro, was 43° to 49° during that period.—C. W. S.

CARP AND IDES SENT TO ENGLAND.—On September 19, 1884, Michael Beverley, M. D., of 52 St. Gile's street, Norwich, England, visited the carp ponds in Washington, and was so much pleased that he requested fish to take back with him to England. He has a small fish-cultural establishment at Brundall, and extended trout ponds of his own. He stated that he had never seen in England any blue carp or leather carp, although he has propagated the scale and mirror carp.

Accordingly, September 30, the Commissioner presented to him 10 young leather carp, 10 blue carp, and 10 golden ides. These were forwarded, in two cans containing about 5 gallons each, to E. G. Blackford, New York, for shipment. Dr. Beverley accompanied them to Liverpool upon the Cunard steamer Servia, sailing October 1, 1884.

The carp endured the passage safely, and were placed in Dr. Beverley's ponds October 4. The golden ides, however, were dead when he arrived on board the Servia. That was attributed to the presence of some decomposing water-weed which had been placed in the can for the purpose of affording food or for keeping the water aerated. The carp also showed signs of being affected by it, but a change of water and the removal of the plant quickly revived them.

PRICES OF CARP.—Mr. Amos Smith, Mountain Hill, Harris County, Georgia, under date of November 24, 1884, says:

"I have been selling carp during the past two years from my five ponds, which cover an area of 5 acres. My prices are as follows: One inch to 3 inches long, 10 cents each; 3 to 5 inches long, 15 cents each; 5 to 8 inches long, 25 cents each; 8 to 10 inches long, 50 cents each; 10 to 12 inches long, $1 each; 12 to 20 inches long, $2 each; spawners, 6 to 12 inches long, 50 cents each; spawners, 4 to 6 inches long, 25 cents each."

STREET DUST INJURIOUS TO CARP.—At the United States fish ponds, Washington, the last week in September, 1884, Dr. Hessel found several thousand sickly carp in the north and east ponds, and subsequently about 150 dead. Upon examination small particles of iron, iron rust, cinders, saw-dust, manure, &c., were found sticking to the gills of the dead fish. A strong wind had prevailed for several days, blowing a large amount of dust from the streets into these ponds, and to this Dr. Hessel attributed the sickness and death of the carp.

A GERMAN VIEW OF AMERICAN CARP-CULTURE.*—At a meeting of the fishery association of Lower Franconia, held November 7, at the Falcon Hotel, and numerously attended, the president of the association, Mr. Zenk, read a paper on the acclimatization of fish, and especially on the introduction of the German carp into North America.

Mr. Zenk said: "Even in the Old World we know that the carp has

* From the Würzburger *Presse*, Würzburg, Bavaria, November 8, 1884. Translated from the German by HERMAN JACOBSON.

migrated considerably, as it has been transplanted from its original home to more northerly latitudes. It is uncertain whether the home of the carp is the Caspian Sea or whether it has also originally been found in the Danube, the Rhine, and the Main. It is certain, however, that it was known to the Greeks and Romans, and that from Central and South Germany it has spread throughout a great part of Europe. Thus the German carp was introduced in England in 1521, into Denmark in 1560, into Prussia in 1769, and thence into the Baltic provinces of Russia. Germany, however, has always remained the principal carp country, and nowhere else has so much attention been given to the raising of carp in ponds. In return for a number of fine good fish which the United States had sent to Germany, the German fishery association has, since 1877, transmitted to America a number of live carp, especially leather and mirror carp. There are quite a number of interesting data relative to the spread of carp in America. Up to January 1, 1883, German carp had been distributed in 17,860 North American waters. In 1881 they were introduced into Canada, in 1882 into Brazil, Colombia, and Ecuador. In America the German carp has grown in a manner utterly unknown even in our best fish-cultural establishments. There are a number of instances to show this. Thus we have a case from Texas where a carp, scarcely 4 inches in length, had in eleven months reached the weight of 4 pounds 11 ounces. As a general rule carp in America increase 3 to 4 pounds in weight in a year. In the beginning many American families did not relish the carp. One lady said that the leather carp deserved its name, as it tasted like leather. Other Americans said that, owing to its rapid growth, its cheapness, and because it is the favorite fish of the Chinese, it was thought that it would bring large masses of the disagreeable pig-tail bearers to the shores of the United States. Gradually, however, the Americans learned to appreciate the carp, and quite recently a Kentuckian declared that a nicely-baked carp was a dish fit to set before a king as well as before a hungry fisherman. Others compare the flesh of the carp to that of the trout, or of the black bass, which is the favorite fish of the Americans. Recently a commencement has been made in America to raise carp in ponds, and the Government has constructed large carp ponds."

Mr. Zenk drew a number of scientific and practical conclusions from various facts connected with the acclimatization of carp in America. The carp thrived best in the Southern States, where the warm season is longer than in the North, and where the carp, abandoning its European habits, does not seek a winter lair, but keeps on eating all the year round, the production of food being very great, owing to the high temperature of the water. The question with us in Germany is, therefore, to place the carp in circumstances which further its growth as much as possible; that is to say, to place them in ponds which are as warm as possible, and remain warm for a long time, to supply them with good and ample food, and to be very careful in the selection of the

fish which are intended for propagation. It is not impossible that the time will come when we shall import carp from North America, either as food-fish, or to improve our race of carp. In December, 1881, 25 leather carp from the Government ponds at Washington were sent to Scotland. The gregarious habits of the carp have already begun to influence American carp-culturists, and their number in the United States has greatly increased.

CARP IN RIVERS.—Writing from Quincy, Ill., under date of December 9, 1884, Mr. S. P. Bartlett, secretary of the Illinois State fish commission, reports that he had that morning received a carp weighing nearly 8 pounds, which had been caught in the Illinois River. It is supposed to have escaped from some overflowed pond. He adds that quite a number have been caught from time to time along the Mississippi River.

STOCKING STREAMS WITH CARP.—Writing from Saint Louis, December 14, 1884, Mr. I. G. W. Steedman, chairman of the Missouri fish commission, states that he is now stocking public waters with 700 spawners and 60,000 young carp, having procured a bountiful supply from the summer's crop.

CARP PLANTED IN TALLAPOOSA RIVER.—Writing from Augusta, Ga., December 13, 1884, Mr. Newton Simmons in charge of Fish Commission Car No. 2, reports that he has planted 1,700 scale carp, in good condition, in Tallapoosa River, at the nearest point to Tallapoosa City, about 2 miles distant.

CARP PLANTED IN ARKANSAS AND RED RIVERS.—On January 4, 1885, Mr. Simmons planted 2,500 scale carp in the Arkansas River at the crossing of the Missouri and Texas Pacific Railroad, and 2,500 in the Red River at Denison City, Tex. A previous plant of 1,500 was made in Trinity River, Texas, early in 1884.

CALIFORNIA TROUT IN NEBRASKA.—Writing from Omaha, Nebr., under date of January 3, 1885, Mr. B. E. B. Kennedy, one of the State commissioners, says: "If the usual success in taking eggs of the California trout (*Salmo iridea*) at the U. S. station, Baird, Cal., attends this year's operations we desire another lot. We have great faith in the ultimate acclimation and successful cultivation of this fish in certain parts of our State. With those heretofore obtained our success has been somewhat unfortunate. The first lot, which had made excellent growth at two years old, were, in one night, stolen entire from the pond in which they were kept. Of those received later we have a goodly number, and they are doing well—as well as those received last year. With one other lot of 10,000 we hope to establish ourselves securely in the production of all we need for future operations."

TABLE.—*Monthly summary of the fresh fish, oysters, &c., inspected by the health officer of the District of Columbia during the year* 1884.

Description.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Bluefish* *a*					21,220	51,405	39,290	38,080	44,925	31,500			226,420
Carp (number)		2	9	16	30								57
Catfish*	3,780	43,390	36,275	19,835	19,845	11,765	16,170	19,145	18,430	17,780	18,650	18,600	243,665
Chubs of North Carolina*	6,600	2,650								1,830	7,900	10,175	29,155
Clams (number)				88,500	587,400	467,000	321,000	230,000	154,000				1,847,900
Crabs (number)				20,900	263,000	194,600	169,000	146,200	57,800	7,700			859,200
Croakers*						24,200	1,665	2,100	525				28,490
Drum (number)					5				88	40			133
Eels*		140	5,105	13,795	6,070	535	745	1,340	1,240	3,190	6,380	2,900	41,440
Flounders*										140	85		225
Herring, fresh-water (number)		1,033	185,430	3,480,819	1,969,023	4,507							5,640,812
Hog fish (number)										600			600
Mackerel, Spanish (number)					19	2,063	4,660	1,532	1,010	1,513			10,797
Mullets*	1,105	9,775	8,590	1,620	740			415	1,255	7,775	1,455	3,815	36,545
Oysters (bushels)	35,385	42,900	36,450	16,845	1,040				15,432	50,780	60,000	49,000	307,832
Perch, white*	3,730	18,345	45,640	33,345	6,985	1,835	8,610	8,625	18,160	23,545	33,925	12,320	215,065
Perch, yellow*	11,795	24,045	48,655	3,705		330	235	400	125	2,055	6,545	7,215	105,105
Pike*	2,430	8,735	11,870	8,265	240	395			1,050	3,140	6,465	4,825	47,415
Rockfish* *b*	1,645	16,695	37,885	21,110	9,765	9,795	19,235	24,030	29,145	50,320	65,270	55,565	340,460
Scup (number) *c*		17			44	512			8				581
Shad (number)			20,351	159,464	49,581	1,715							231,111
Shad, winter*	3,180	2,830	70				150	90	2,120	8,110	9,370	4,855	30,775
Sheepshead (number)					1,086	776	178	155	291	61			2,547
Spot (number)					300	360	2,620	5,570	7,615	14,680			31,145
Star fish* *d*							2,450						2,450
Sturgeon (number)				9	503	534	313	127	102				1,588
Taylor, fresh-water (number) *e*			2,312	17,372	2,002								21,686
Terrapin, diamond-back (number)												264	264
Trout*						19,620	12,500	5,135	16,900	22,255	9,295	425	86,130
Trout, gray (number)					6,243								6,243
Trout, salmon (number)					1,628		305		430	880			3,243
Turtle, sea (number)					54	33	30	4	4	1			126

* Reported in bunches, but here reduced to pounds.
a Or salt-water taylors.
b Or striped bass.
c Or porgies.
d Or crevallé.
e Or skip-jacks, or hickory shad.

A MOVING HATCHERY.—In the evening of February 9th one of the Fish Commission cars left Washington for New Orleans, having on board, among other things, 200,000 whitefish eggs. These were to be taken to New Orleans and hatched for the exhibition. All arrangements had been made for holding them in circulation in water while *en route*. Unexpectedly, the handling of them caused hatching to commence, and Colonel McDonald, who was in charge, found himself confronted with the problem of transferring and collecting the fry while the car was in rapid motion, it being attached to a passenger train. The experiment, however, proved perfectly satisfactory, the hatching-jars worked just as well in the car as on the hatching tables at the hatchery. The fry were collected in aquaria as fast as hatched. The circulation of water was obtained by use of the tanks in the upper part of the car, which are refilled by pumping as often as necessary.

TRIP OF CAR NO. 3 TO MICHIGAN.—On November 7, 1884, Mr. Ellis took on board at Central Station 17,000 carp, 200 goldfish, 12 ides, and 6 adult carp. He left Washington that evening and arrived at Columbus, Ohio, on the afternoon of the 8th. Here he delivered to the Ohio commission 88 pails containing 4,000 carp. On the 10th he delivered to four express companies a total of 341 pails of carp for applicants in Ohio. November 11th, at Indianapolis, he delivered to three express companies 235 pails of carp for applicants in Indiana. From Indianapolis, the Wabash, Saint Louis and Pacific Railroad furnished free transportation to Toledo, which city was reached in the evening of the 12th. From this point the Flint and Pere Marquette Railroad furnished free transportation to Northville. On the 13th, 41 pails of carp were delivered to the American Express Company for applicants in Michigan, and the 6 large carp with 750 small ones to Mr. Clark for filling later orders. About 37 carp were lost on the trip.

There were received from Mr. Clark 10,000 trout eggs, 20 large whitefish, and 25 small whitefish to be transported to Washington. The car left Northville at 1.20 a. m., November 14. At Monroe it took on board 25 large whitefish weighing from 2½ to 8 pounds each, received from Mr. S. Root. The return passage was by way of Toledo, Pittsburgh, and Harrisburg. The car reached Washington November 16, having traveled 1,778 miles. The 10,000 trout eggs were delivered at Central Station to be hatched. A part of the large whitefish died in transit, but the remainder were delivered at Central Station. Several of those whitefish are now (April 1, 1885) in the tanks at Central Station, and appear to be in good condition.

CARP FISHING.—The following is from a letter by Baron P. Tcherkassoff, published in the Fishing Gazette of January 3, 1885:

In the southern part of Russia carp are very plentiful, and sometimes attain the enormous weight of 60 pounds. The largest specimen taken with rod and line which I have heard of weighed 36½ pounds. The tackle on which it was captured was of the most genuine "clothes prop" description.

In this part of the country these fish are fairly plentiful, and if they do not attain the above-mentioned enormous weight, still, 20-pounders are by no means uncommon, though it must be owned they seldom are taken with rod and line. The largest I ever caught weighed 15 pounds, and he ran out at least 70 yards of line before I succeeded in stopping him, the rod all the time bending like a bow.

The season for carp generally opens between the 14th of July and the 2d of August. It continues sometimes as late as the end of September or middle of October.

The best baits are cockchafer grubs, those from ¾ inch to 1 inch in length being by far the most killing; maiden lobs, brandlings, marshworms, wasp grubs, gentles, boiled potatoes, creed wheat, and bread paste. Of all these baits cockchafer grubs and marshworms are, according to my experience, the most killing ones; but on other rivers where I have had no opportunity to fish, creed wheat is *the* bait. As to ground-baits, those most generally used are buckwheat, groats, and rye, well boiled; sometimes curd is used, as well as well-boiled potatoes, mashed and kneaded into balls about the size of a hen's egg.

The best time of day is between one hour before sunrise and noon; but, strange enough, one day you get all your fish just before or soon after sunrise; another, you get them between 10 o'clock and noon. When the carp are "on" I have known as many as 9 being caught from half-past 9 to 11 o'clock, 6 fish smashing the tackle during this time. Those caught averaged 4 pounds each.

This year's carp fishing has been an utter failure. The bream, on the contrary, were, for about two weeks well "on," so that I seldom failed to get my 25 to 35 pounds in a morning's fishing from 3 till 9 o'clock.

Speaking of baits, I think it may not be uninteresting to say that cockchaffer grubs are a most killing bait for master chavin. Another most killing bait for this gentleman being the *raw* tail of a crayfish. The length of this tail should not exceed 1½ inches. It is much easier to peel when slightly parboiled; but in point of attractiveness, according to my experience and many of my countrymen, it is not to be compared with the raw bait.

FISH-CULTURE IN ILLINOIS.—Writing from Quincy, Ill., January 10, 1885, Mr. S. P. Bartlett, secretary of the State commission, says the board has not spent very much money on trout and salmon, but has done a good deal in planting native fish in their waters and with excellent results. During November and December the State board received 5,000 communications relative to carp.

FISH-CULTURE IN WYOMING TERRITORY.—Writing from Cheyenne about January 8, 1885, Mr. H. J. Maynard says:

"The Territorial legislature has made an appropriation with which we have built a small but complete hatching house, and we are now successfully hatching whitefish and lake-trout eggs received from the United

States Commission. Several small plantings of New England trout in the Territory have succeeded most admirably. These have grown within 4 years to weigh over 3 pounds in the Little Laramie River. It is thought that this will be a useful fish for all the streams of the Territory."

PROPAGATING TROUT IN KENTUCKY.—Writing from Louisville, January 10, 1885, Mr. J. N. Neelley says:

"Early in 1880 I received a can of trout which I placed in my pond and spring streams. I guarded them carefully and had the satisfaction of having hundreds of beautiful trout. So jealous of them was I that I never took one or allowed any one else to do so. In the spring of 1883 a water spout burst the banks of my reservoir and my trout went into Gun River. My father picked up a number in the sand (9 to 12 inches long) and gave them to the neighbors. I spent two weeks there last fall and found trout in all the small streams running into Gun River, and am well satisfied that I have stocked the stream. Fishermen come from all parts of the country to get a chance at them. A conductor on the Michigan and Ohio Road told me that he took 14 in an hour."

CULTIVATION OF CALIFORNIA TROUT AND LAND-LOCKED SALMON.—Mr. G. W. Delawder, one of the Maryland fish commissioners, writing under date of Oakland, February 8, 1885, says:

"In 1882 or 1883, I got from you 5,000 California trout eggs, and from this lot have already sent you specimens of young. I also received land-locked salmon eggs. Both lots of young were deposited in Deep Creek, and the yearlings of both were taken last summer by hook and line, showing a most wonderful development. When the spring opens I shall be able to show the progress they have made for the second year. Deep Creek has a wonderful depth, an abundance of food, pure water, and is capable of maintaining large fish, and a great number of them."

TROUT FOR SALE.—Mr. George A. Starkey, of Troy, N. H., states that he has 1,000,000 trout eggs ready for shipment in January, 1885, and that from February 1 to April 1 he will have in the Monadnock trout ponds a considerable quantity of fry for sale. His prices are as follows:

TROUT EGGS.

Per thousand, up to 10,000	$2 75
Per thousand, over 10,000 up to 25,000	2 50
Per thousand, over 25,000	2 25

TROUT FRY, THREE MONTHS OLD.

Per thousand, up to 10,000	$5 00
Per thousand, over 10,000 up to 25,000	4 50
Per thousand, over 25,000	4 00

CODFISH TAKEN OFF THE COAST OF NORTH CAROLINA.—Mr. E. G. Blackford, of Fulton Market, New York, writing under date of February 19, 1885, says: "I had yesterday a codfish, weighing 6½ pounds, that was caught off the coast of North Carolina in shad nets."

PRICE LIST OF HUGO MULERTT, 507 RACE STREET, CINCINNATI, OHIO.—The following list is furnished under date of February 12, 1885:

Common goldfish:		
Small and medium	each	$0 25
Large	do	50
Japanese goldfish:		
Fringetail, small and medium	$2 50 to	10 00
Fantail, small and medium	each	50
Comet, small and medium	do	1 00
Nymphe, small and medium	do	50
Chinese paradise fish:		
Small (*Macropodus*)	per pair	1 00
Old enough to spawn	do	5 00
German carp (mirror, leather, and scale), young	each	25
German gold orfe, young (4 inches)	do	1 00
German tench, young	do	
Blue and pumpkin-seed sunfish, medium	do	25
Straw, moss, and black bass, small	do	50
Yellow or ring perch, and rock bass, small	do	
Black-nosed dace	do	
Dogfish (mud dace)	do	25
Black catfish and top minnows, small	do	15
Newts	do	20
Tadpoles	do	5
Snails	per dozen	25
Aquarium sand	per quart	10
Aquarium cement	per pound	35
Dip net	each	15
Dipping tube	do	25
Cultivator	do	40
Wiper	do	40
Fish food	per box	10
Nymphæa odorata (flowers white), strong roots	each	25
Nymphæa flava (flowers yellow, foliage variegated), strong roots	do	50
Nymphæa flava yearlings (fine for aquariums)	do	25
Nymphæa spharocarpa rubra (flowers carmine pink), strong roots	do	
Nelumbium luteum (seed)	do	10
Nelumbium speciosum (seed)	do	25
Nelumbium rubrum (seed)	do	25
Nuphar advena (roots)	do	50
Aponogeton distachyon (strong roots)	do	2 00
Limnocharis humboldtii	do	50
Villarsia nymphæoides	do	25
Trapa natans (seed)	do	25
Hydrocharis cordifolia	do	25
Sagittaria sagittifolia	do	5
Sagittaria lancifolia	do	25
Sagittaria natans	do	25
Pontederia cordata	do	25

Iris (assorted)	each..	$0 10
Cyperus alternifolius	do...	25
Ceratophyllum demersum	per bunch..	10
Myriophyllum spicatum	do...	15
Ludwigia florida	do...	25
Anacharis canadensis	do...	10
Cabomba viridifolia and rosæfolia	do...	25
Potamogeton crispus	do...	15
Vallisneria spiralis	each..	10
Utricularia vulgaris	do...	10
Lemna minor	per mass..	10

APPEARANCE OF VARIOUS KINDS OF FISH.—Writing under date of May 18, 1885, Mr. Frederic Stanly, keeper of the Fourth Cliff life-saving station, at Scituate, Mass., states that the first mackerel made their appearance off Scituate May 17, 1885.

The keeper of the Cape Fear life-saving station, Mr. Dunbar Davis, writes that a small school of menhaden made its appearance in the vicinity of that station May 10, 1885. There were no other fish visible except porpoise, which remain on the coast the year round.

Mr. David A. Vail, keeper of the Tianna life-saving station, at Atlantieville, N. Y., writes that alewives first appeared on that coast February 26; porgies, April 29; sea-robins, April 22; mackerel, April 30; butterfish, April 30.

Mr. N. B. Kiely, keeper of Parramore's Beach life-saving station, writes from Wachapreague, Va., that the steamer Daisy caught 50,000 menhaden on that coast May 19, being the first taken in the season of 1885.

Mr. G. A. Veeder, keeper of the Surfside life-saving station, Nantucket, Mass., states that the first codfish of the season was caught off Surfside station April 7, 1885, about 1½ miles from the shore, in about 8 fathoms of water. The fish would average about 8 pounds each. The people here generally catch codfish from March to the fore part of June, after which the cod start off for deeper water, 15 or 20 miles from shore. Very little spawn is found in them in the spring. Fish caught in the spring are much larger than those caught in the fall. Fish strike in about the last part of October and stay around until the middle of December. In mild winters they are around all winter, but we have to go farther offshore for them; we find much more spawn in them in fall than in spring.

THE FIRST MENHADEN.—A small school of menhaden was seen going north April 23, 1885, by the employés of the Great Egg life-saving station, located 6 miles below Absecom light, on the New Jersey coast. The keeper, Mr. L. P. Casto, whose post-office address is Atlantic City, N. J., kindly forwards the information.

MOVEMENTS OF SHAD.—On the morning of April 17, 1885, Mr. E. G. Blackford, of Fulton Market, received from New Bedford, Mass., twenty-two shad that had been caught in that vicinity. They were large, weighing from 5½ to 6 pounds each, and had every characteristic of the

Connecticut River shad He supposed these specimens to be from a school of shad which was waiting for a rise in temperature before making for the Connecticut River.

BAIT FOR LOBSTERS.—A. C. Smith, M. D., who lives at Newcastle, New Brunswick, writing under date of February 23, 1885, says that the most successful method of attracting lobsters is by placing in the traps mackerel refuse, suspended in *closed* cotton bags. This illustrates the keen sense of smell possessed by the lobsters.

Since the publication of Dr. Smith's notes on page 121 of this volume, he states that he has learned that lobsters are found on the coast of Labrador.

SAWDUST INJURIOUS TO FISH.—Mr. J. J. Brown, of Ludington, Mich., writing under date of June 3, 1883, states that mill-owners at Ludington and other places have dumped large quantities of sawdust and shingle shavings into Lake Michigan, covering the bed of the lake for miles in a manner that destroys the feeding grounds of the fish.

TROUT PLANTED IN MICHIGAN.—Mr. J. E. Bassett, of Ypsilanti, Mich., under date of February 2, reports that 25,000 lake trout obtained from the Northville hatchery last May were planted in a lake at Lodi, 10 miles southwest from Ann Arbor. A few which were saved out were put in a small reservoir and grew finely, but those in the lake have not yet been heard from.

Mr. Bassett has in his own ponds both brook trout and California trout of different weights, from 2½ pounds down to yearlings. He has fed them through the ice this winter with chopped liver.

One thousand California trout fry obtained from Northville he planted in a brook 2 miles southwest of Ypsilanti. He reports that they have done well, and that a few of them were taken last November by parties fishing for bait minnows.

TROUT AND WATER SNAKES.—Mr. F. Best, of Andover, England, has a trout which was found dead in shallow water with about 18 inches of the body of a water snake protruding from its mouth. The fish was carefully opened, and in it was found a partially digested snake, measuring 27 inches. When alive it must have been longer, as its head was gone. That it had been swallowed alive was proven by the fact that the stomach of the trout had been bitten by the snake. It is well known that trout are fond of eels, and it is possible that the trout mistook the water snake for an eel.

OPINION ON EDIBLE QUALITIES OF THE CARP.—E. C. Spitzka, M. D., of 137 East Fiftieth street, New York, under date of October 22, 1884, say: "As to the carp served at the last dinner of the Ichthyophagous Club, I would say that its flavor and the general character of the meat were identical with that of the carp I have frequently eaten in Germany and Austria. In fact, if I had been blindfolded I would have immediately recognized the fish by its flavor. To some the sweetish character of the carp's meat is an objection; this is overcome on the Con-

tinent by preparing it with piquant sauces and spicing somewhat on the same plan that the sweet flavor of the rabbit is neutralized in the better class of preparations made of that animal's meat."

CARP IN ENGLAND 300 YEARS AGO.—In a description of the Thames River published in 1577, Holinshed spoke of carp as not "long since brought over into England." John Taverner referred to carp in his "Certain Experiments Concerning Fish and Fruit," printed in 1600. Gervan Markham freely spoke of it in his "Art of Angling," published in 1613. In 1532 entries appeared in the royal accounts of rewards to persons to bring carp to the King.

FISH AT CENTRAL STATION.—Under date of December 16, 1884, Mr. J. E. Brown reports: "There are at Central Station, this date, 215,000 small leather carp, 500 small scale carp, 400 blue carp, 600 tench, and 175 yearling leather carp. The whitefish delivered here by car No. 3 are in fine condition and I think will winter nicely. There are fourteen of last year's crop, and one two-year old and four large ones that would weigh 4 or 5 pounds each. All the above fish are in splendid order."

DESTRUCTION OF YOUNG FISH BY LARVÆ OF DRAGON-FLIES.—In the Hungarian Rovartani Lapok for December last, L. Biró states that the larvæ of some *Libellula* (species not determined) have made such ravages in the piscicultural establishment of Count Pulffy at Szomolány that in a pond in which 50,000 young fish were placed in the spring of 1884, only 54 could be found the following September, but there was a large quantity of the larvæ of the *Libellula* referred to.

FISH EATEN BY MUSKRATS.—Mr. A. A. Mosher, writing from Spirit Lake, Iowa, under date of April 27, 1885, says: "A muskrat got into a large box containing water 1 foot deep where there were minnows from 2 to 4 inches long. He caught a number and ate all but the heads, which we found lying on the bottom."

USE OF GIANT KELP STEMS BY THE INDIANS.—Mr. James G. Swan, writing, under date of February 14, 1885, from Port Townsend, Wash., says: "I was fortunate yesterday in seeing some Fort Rupert Indians who live at the northeast part of Vancouver Island, near Nawitti. The Fort Rupert band of Nimpkish Indians make great use of the giant kelp stems (*Nereocystis*). Their method is to first peel off the outer cuticle of the kelp, then place it over a slow fire, and as it dries the salt exudes and forms a crust. This is rubbed off and the kelp stem blown up full of wind, and again hung up to dry for a brief period. It is then again rubbed and blown full of air. This process is repeated until the kelp is of a leathery consistence, and it is then used to hold dogfish oil and is equal to an India-rubber tube. The Indians I referred to have promised to prepare me a quantity, which, when received, I will forward to you. I will also have a barrel filled with the green kelp, leaves and all, and fill the barrel with strong pickle. This will give an opportunity of testing the vegetable in its green and prepared state."

Vol. V, No. 8. Washington, D. C. April 1, 1885.

20.—RESULTS OF PLANTING YOUNG WHITEFISH IN LAKE ERIE.—WHAT THE FISHERMEN THINK OF WHITEFISH PROPAGATION.

By FRANK N. CLARK.

After the close of the fishing season of 1884 in Lake Erie, I began an inquiry to ascertain whether there had been an increase or decrease in the catch of whitefish as compared with that of former seasons. The investigation was conducted by personal interviews, through a representative, a practical fisherman, with the leading fishermen and dealers, and covers most of the important fisheries of that part of the lake from Erie, Pa., westward to Toledo, Ohio. The results are most gratifying, as it is conceded by all and shown by the reports that the aggregate catch of whitefish was considerably in excess of that of any season for several years. The results are also especially encouraging to fish-culturists, as all the facts and statements point to but one conclusion; namely, that the increase is due to the planting of young fish from the hatcheries.

No disappointment would have been felt had there been no perceptible increase, as much was required to offset the extensive and exhaustive fishing carried on all over the lake, on both the spawning and feeding grounds, which was causing a gradual decrease of the catch. For many years every spawning ground had been literally covered with nets during the spawning season, while hundreds of gill-nets have been employed on the feeding grounds in deeper waters and thrown across the path of the runs toward the spawning grounds. In no other of the great lakes has the fishing industry been pursued with greater persistence and skill than in Lake Erie. Notwithstanding this, however, we find that not only has the decrease been arrested, but that there is a tangible and satisfactory increase.

The figures given below show in round numbers the aggregate plantings of whitefish fry in Lake Erie, from the beginning of the work, by the United States and Ohio and Michigan Fish Commissions. Some plants were also made by the Canadian Commission during the years mentioned, but I am unable to give the figures:

Spring of 1875	150,000
Spring of 1876	300,000
Spring of 1877	450,000
Spring of 1878	12,000,000
Spring of 1879	7,000,000
Spring of 1880	7,000,000
Spring of 1881	13,000,000
Spring of 1882	42,000,000

These figures include the latest plantings that could possibly be called due in the fall of 1884. Under the current method of computing the numbers of young fish in tanks and cans, there is no doubt that the estimates shown in the above figures are much too large.

Following are a number of statements from fishermen and dealers, in substantially the exact language of the parties making them, with regard to the catch and the value of fish propagation and planting:

L. Streuber, Erie, Pa., says: "Am a dealer and shipper of frozen fish, and fish considerable twine. Can give you the figures of my catch for only the past two seasons, which is as follows: Catch of whitefish for 1883, 110 tons; 1884, 150 tons. I believe the propagation of whitefish to be a great help toward keeping up a stock in the lakes; so much so that I am doing all I can to get a hatchery started here, believing it will pay."

C. D. Carter, another dealer and fisherman in the same city, says: "My catch of whitefish for the past two years is as follows: 1883, 175 tons; 1884, 225 tons. I think that the planting of young whitefish in Lake Erie has already done a great good toward keeping up and increasing the stock of whitefish in its waters. I hope to see the hatcheries kept up, and would like to see one here in Erie, believing we have a good location for one, and that it is a good point to plant fish from, as there are no carnivorous fish caught at the season of the year when the young fish would be put in."

John Harlow & Co., of Erie, make the following statement: "For the past five years our annual catch of whitefish has been about 150 tons, until 1884, when it was 200 tons. The increase of 50 tons I attribute to the planting of young whitefish from the hatcheries. I am very much in favor of the planting, and hope it will be kept up, as I am satisfied that it is of great benefit to the fishing interest of the lake. A few seasons since we commenced catching very small whitefish—so small that we had to get smaller-meshed nets, and now we are getting a larger class of fish again."

H. Divel, fish dealer and practical fisherman, also of Erie, says: "I have been fishing for some time, and think the whitefish for the past three years have been increasing. I can give the figures of my catch only for the past two seasons, as follows: 1883, 30 tons; 1884, 50 tons. I think the business of hatching and planting is of great benefit in keeping up the stock; for, with the increase of twine, the whitefish must soon be caught off if nothing is done to keep the stock good. There can be no reasonable doubt about the young fish living and becoming full grown. They stand just as good a chance as those hatched naturally, their danger from carnivorous fishes being no greater than those hatched on the reefs."

B. Divel, of Erie, gives similar testimony: "My catch of whitefish has improved for two or three years. The figures for the last two seasons are: 1883, 30 tons; 1884, 50 tons. From the fact that whitefish are

steadily increasing in numbers. I believe the hatching and planting of the young is a success, and the cause of the increase."

Charles Joles, of Erie, a gill-net fisherman, says: "I fish gill-nets off Elk Creek. Cannot say how many whitefish I caught in the different years, but know I caught more in 1884 than in any season for several years. I attribute the gain to the planting of young fish at the upper end of the lake. I am satisfied that were it not for this whitefish would become so scarce that it would not pay to fish for them."

Rudolph Sifield, of North Bass Island, says: "I fish with pound-nets and own some gill-nets, but would willingly put the latter in a pile and burn them if gill-net fishing could be prohibited. Gill-nets are a great detriment to natural propagation, as they are set on the reefs in spawning time, right where the fish go to breed, and the schools are broken up or driven off entirely, and the eggs are then deposited in the mud and never hatch. Good results may now be seen from fish planting, but the business has not been carried on long enough nor on a sufficient scale to tell what it will do in the long run."

Simon Fox, of North Bass, gives his opinion thus: "Have been in the fishing business for years, and until the past season never believed there would be any results from the planting of young fish. Now I am fully convinced that good results are to be seen, and if it is continued great results will follow."

Jasper Snide, of North Bass, says: "Our twine caught a few more whitefish in 1884 than in 1883, and I think we should have done still better but for the unfavorable fishing weather, it being so still that the fish remained on the reefs beyond our nets continuously until we got those heavy blows, which drove them off entirely. Formerly I did not have any faith in the planting of young whitefish, but am now sure we can see good results. We now catch a great many of a smaller class of fish which we never did before the planting was commenced; and if the stock had not been kept up in some other than the natural way they must have decreased in numbers, and we cannot see that they have for a few years."

George Axtell, of North Bass, states: "Whitefish are increasing in numbers all the time, at least this is true of my own nets, and I feel certain that it is owing to the planting of young fish from the hatcheries. Last fall I caught numbers of small whitefish, such as I never before saw caught in gill-nets."

William Axtell, practical fisherman, of North Bass, says: "I know that the planting of young fish is a great help to the fishing industry. Would like to see more hatcheries put up—enough to take care of all the eggs that could be taken."

Eugene McFall, clerk of the steamer Jay Cooke, freight and passenger boat plying between the islands and Sandusky, says: "I think there is an increase in the catch of whitefish, and I suppose the planting must account for it. We carried from the islands in 1883 about 132,000

pounds of whitefish, and in 1884, 170,000 pounds; an increase of 19 tons for 1884."

George Winne, of Locust Point, says: "I fish gill-nets on the reefs off Toussaint Point. In 1883 I caught 2 tons of whitefish from 60 nets, and in 1884, 6 tons from 36 nets. A few years ago it got so it did not pay to go out on the reefs to fish, and I quit and went sailing. Since the planting of young whitefish has been carried on fish have become more numerous and I have done very well fishing, but best this last fall. Think if the planting is not kept up whitefish will soon become scarce again. Think a much greater percentage of eggs put into hatcheries will live to become mature fish than those deposited on the reefs by the fish themselves, for the reason that the former are protected from their enemies while hatching, and after the young fish are planted their chances are just as good."

M. Shepherd, also of Locust Point, states: "Am fishing 15 pound-nets off Locust Point. My catch the past season was about as usual—no material difference. Think the hatching business a good thing, but the proper place for a hatchery is on one of the islands; then the eggs would have the natural water, and when the fish are planted there would be no change from the water they were hatched into that which they are planted in."

Nelson Parsons, a practical fisherman of Vermillion, says: "I have watched the fishing interests very closely for a number of years, and noticed that whitefish were steadily decreasing in numbers, until the supply was replenished by the planting of young fish from the hatcheries. If something of the kind had not been done, I think that whitefish would, ere this, have become so scarce that it would not pay to fish for them. Formerly, we used to catch whitefish of all sizes at the same time, but this season at Cleveland, where I was, the fish were nearly all of one size—looked as if they were all of the same age, and I believe they were a school of the planted fish. I think if fishing is continued it must be done in this way."

Edson & Nichols, of Vermillion, caught one ton less of whitefish in 1884 than in 1883, but say: "We do not attribute the falling off to a growing scarcity, but to the direction and amount of wind, which is everything to us here in the fishing season. We think the hatching business of great importance, and the only way of keeping up the fishing industry."

Bert Parsons, also of Vermillion, caught no more whitefish in his pound-nets off Vermillion in 1884 than in 1883, but caught double the number in his gill-nets near the islands. He says: "I think if there had been favorable winds for pound-net fishing we would have caught more than double the amount of whitefish in our pound-nets last fall. I know the business of planting has been of great benefit, for in my gill-nets fished about the islands I caught double the quantity last fall that I did the year before. The figures are: 1883, 5 tons; 1884, 10 tons."

Leidheiser, of Vermillion, says: "I cannot give the amount of my catch, but it was rather light, owing to the unfavorable winds we had for our coast. I think the hatcheries are all right, and do a great deal toward keeping up the stock, and that the business should be continued and extended beyond where it now is."

Post & Co., of Sandusky, give some excellent testimony: "Yes, sir; I know that the business of propagating whitefish is a great benefit. In fact, if the United States and State hatcheries were to cease working I believe it would pay the fishermen and dealers to continue it themselves. I would be willing to be taxed my share for supporting it. I understand that at Erie and Dunkirk a great many small whitefish were taken weighing a pound to a pound and a half, which was never done until the last two or three years, and they increase year by year, which is good proof that they are some of the planted fish.

"I received the fish from 100 pound-nets last year (1883) and from 110 this year (1884), with the following results: 1883, 40 tons whitefish; 1884, 80 tons whitefish.

"Whitefish are not now decreasing; but from the number of pound and gill-nets in use to catch them, a decrease is sure to follow unless the artificial hatching is continued to keep up the supply.

"I am opposed to fishing such long strings of pound-nets, and think the gill-netting needs regulating. The gill-netters commence away down below, off Buffalo and Erie, in deep water, and fish all summer; then, as the fish move up toward the head of the lake to the spawning grounds, the nets are moved right along with the runs, so that they are hunted almost the year round, which is done with no other kind of fish."

Harry Molyneux, of Sandusky, gives some valuable testimony: "Am a practical gill-net fisherman. A few years ago fishing on the island reefs got so poor that I gave up going there; but in the fall of 1882 I tried it again and did very well. In the fall of 1883 I caught double the amount of whitefish I did the fall before; and this last fall I caught almost twice as many as in 1883.

"I credit all the increase to hatching and planting, and would like to see more hatcheries."

William Rehberg, pound-net fisherman, of Middle Bass Island, says: "Think the hatching a good thing, but the planting has not been properly done long enough to tell really how much benefit it is toward keeping up the supply of whitefish. Think the supply could be kept up in Lake Erie by prohibiting gill-net fishing west of Kelly's Island, which would give the fish a chance to breed on the natural spawning reefs, where the gill-nets are now placed."

Caspar Voight, of Sandusky, says: "My catch of whitefish in the past two seasons was as follows: 1883, from 35 pound-nets, 37 tons; 1884, from 35 pound-nets, 45 tons.

"I have not thought much about the hatching business, but it must

do some good; at least, there seems to be an increase in whitefish the past two or three years."

Simon Schact, of Sandusky, says: "My catch for the past two seasons is as follows: 1883, 42 pound-nets, 40 tons whitefish; 1884, 48 pound-nets, 50 tons whitefish.

"I believe the planting of fry to be a good thing, and the only way the fishing can be kept up. I fear, however, that the way the gill-netters are catching them, and going on the breeding grounds and disturbing them while spawning, will do more harm than the hatcheries can do good. The fishermen down at Erie and Dunkirk receive the most benefit from the planting, as they fish with gill-nets all summer, and are using smaller-meshed nets every season on purpose to catch the small whitefish."

Lay Brothers, of Sandusky, say: "Our catch of whitefish for the past two seasons was as follows: 1883, from 20 pound-nets, 16 tons; 1884, from 30 pound-nets, 26 tons.

"We think it is plain to see that there is a benefit to be derived from the hatcheries, and would like to see as many in operation as there are eggs to fill."

Dewey & Co., of Toledo, say: "Our catch the past season was rather light. We do not attribute this to a scarcity of whitefish, but to the unfavorable winds that prevailed on our Monroe coast grounds all the fall until a late date; then, just as the fish began to come on, we had two severe blows from the west, which drove the fish from the shore, and they did not come back, or, if they did, we did not get them, as our twine was out.

"We think the business of planting young fish an excellent thing; can see no reason why it should not be, as every fish planted in that way is a clear gain. We see no reason why planted fish should not stand as good a chance to live and become grown fish as those that hatch on the reefs."

Wm. St. John & Co., also of Toledo, say: "Our receipts of whitefish for the past two seasons are as follows: 1883, from 20 pound-nets, 6,000 pounds; 1884, from 45 pound-nets, 18,000 pounds.

"We do not see that fish-planting has been of much benefit to this end of the lake, but I am informed that great benefits have been realized farther down.

"We would like to see Congress take hold of the matter and enact a law to control and restrict the fishing with gill-nets; also with such long strings of twine. Although we ourselves are fishing 20 and 21 pounds in a string, we would like to see them cut down to six at most on main shore, and not more than three off the islands, or any place where there is a narrow channel. Then the whitefish would have a better chance to get through to the coast and reef spawning grounds at the head of the lake, which they would do if they were not turned back by the long strings of twine."

J. C. and J. H. Davis, of Toledo, say: "Our catch of whitefish for the past two seasons was as follows: 1883, 6 tons, and 1884, from the same number of nets, 6½ tons.

"Do not know that planting of young fish has been of much benefit to us at this end of the lake, but can see no reason why it should not benefit somebody. Certainly, every young fish put in makes one more chance for a whitefish, as the eggs would be lost if not taken."

E. Alvord & Son, of Sandusky, say: "Our receipts of whitefish for the past two seasons were: 1883, from 52 pound-nets, 23 tons; 1884, from the same number of nets, 30½ tons.

"Yes, we think that propagation is a good thing, and a great help in adding to the supply of fish in the lake. We think the young fry stand just as good a chance of becoming full-grown fish as those hatched in the lake.

"But there ought to be a law to stop fishing with gill-nets, for the reason that down below here, in deep water, where they fish through the summer, it is estimated that at least one-third of those caught in hot weather are unfit for market, and are thrown away, which is an outrage. And then in the fall the gill-nets are set on the spawning reefs, just when and where the fish should be left undisturbed."

Bear & Ruth, of Sandusky, state that in 1883 their catch of whitefish from 9 pound-nets was 7½ tons, and in 1884, from 11 pound-nets, 10 tons.

"The planting of young fish is undoubtedly of great benefit to the the fishing interests. Were it not for this the stock in the lake would rapidly decrease."

A. Bremiller, of Sandusky, gives the following figures: Catch of whitefish in 40 pound-nets, in 1883, 66 tons; in 1884, 69 tons.

"I think there is positive proof of the benefit of the hatcheries, from the fact that during late years, say the last two or three, there have been a great many small fish caught—smaller than ever were caught before the planting was commenced in the lake. Another fact to be taken into account is that the facilities for catching are becoming greater every year, and if the supply had not been kept up in some way, the stock must certainly have decreased, which is not now the case."

A. J. Gustavus, pound-net fisherman, of Huron, puts it in this light: "For every million fry planted there are a million more chances for whitefish. I think the greatest results are to come, as the business is not yet old enough for us to expect much benefit."

E. D. Smith, of Marblehead, says: "I know the fish-hatching to be a grand thing, for the reason that I have caught thousands of whitefish this season not weighing over a pound to a pound and a half each, and formerly I never caught them. I believe these small fish are some of those planted from the hatcheries."

Fred Motrie, of Port Clinton, says: "I fished 6 pounds in the fall of 1883, and 5 in the fall of 1884. Have no record of my whitefish catch

for either fall, but know I caught more in 1884 than in 1883, perhaps 20 per cent. more. The hatcheries are undoubtedly a good thing and should be kept up. While the eggs are in the jars they are out of the way of sturgeon, suckers, and all fish that live mostly by sucking up spawn; and when the young fish are turned loose they will look out for themselves."

Felix Courchaine, also of Port Clinton, says: "I did very well the past fall, in fact the fishing was the best it has been for years. I caught 6 tons with 26 gill-nets. I have every reason to believe that we are getting results of the plantings from the hatcheries; and why shouldn't we? The fry planted in this way stand an equal chance with those hatched in the lakes, and as for taking care of themselves, I think nature will look out for that. I should be sorry indeed to see the hatching of whitefish discontinued."

F. Perry, a practical gill-netter, of Port Clinton, says: "In the fall of 1883 my catch of whitefish from 19 nets was 1 ton, and in the fall of 1884, from 37 nets, 6 tons—six times the catch of the year previous, with double the nets, on the same grounds. I think we are getting great results from the planting of young fish, for before it was commenced whitefish were fast playing out. But now they are becoming more plentiful again, and I know of no cause for it except the planting of the young in large numbers from the hatcheries."

From all the places named above, as well as other points on the lake, much more evidence of the same kind might be offered; but it would be merely a repetition of what has already been given. Accurate data showing the total whitefish catch of the lake for a term of years, or even for one season, would be almost impossible to obtain, from the fact that many fishermen classify their entire catch simply as "hard fish," "soft fish," &c., whitefish, of course, being included in the former. The statements, however, cover sufficient grounds to form a reliable basis for conclusions. They show that while there was no perceptible increase the past season in the whitefish runs at the extreme west end of the lake, there was a decided increase on the coast and island reefs farther down, and a very marked increase in numbers still farther down, on the feeding-grounds, in deeper water, where gill-nets are operated. On the whole, sufficient is shown to prove beyond a doubt that the aggregate catch was greater than for several years, that whitefish are decidedly on the increase in Lake Erie, and that the increase is simply the legitimate result of the work of the hatcheries. The removal from the lake every year of thousands and hundreds of thousands of adult fish, whether taken directly from the breeding-grounds or not (the results are the same), must certainly ere this have caused a very material decrease in the stock but for the compensation of young from the hatcheries.

NORTHVILLE, MICH., *February* 18, 1885.

21.—NOTES ON THE LOBSTER—HOMARUS AMERICANUS.

By A. C. SMITH.

I cannot learn of lobsters having been found on the coast of Labrador. In this province (New Brunswick) they are found as far north as the mouth of the Restigouche. Newfoundland lobsters are very much larger than those caught in New Brunswick or Nova Scotia. The lobsters known to fishermen on the coast of Nova Scotia are roughly distinguished into three kinds according to the nature of their feeding grounds—cove lobsters, coast lobsters, and deep-sea lobsters. There is no appreciable difference in size or structure, but chiefly in the coloring and composition of the shell, a circumstance which enables one to decide with tolerable accuracy where any given specimen has been caught. The cove lobster is chiefly found near the shores in small harbors and other sheltered places where the bottom is soft, and covered with a dense growth of sea-weed. Its shell is never so thick or firm as that of the other kinds, is generally of a dull, somber color, and contains a smaller proportion of calcareous matter. Consequently it yields quite readily to slight pressure, except near the claws. They are not in great demand because not fitted to stand the necessary handling, or to survive when packed in the wells of smacks.

In New Brunswick, as in the sister province, the coast lobster is the one sought after. This lobster has its haunts around the ledges of the coast, and in the deeper waters of open bays. Thickets of kelp on the bottom, and patches of other marine weeds, are favorite resorts for this kind, especially in early spring. Its shell is dark, mottled with green, and sometimes beautifully diversified near the under edges with a variety of hues. It is capable of considerable resistance, and serves effectually as a protection against the rocks, and against attacks. When plentiful they can be seen in great numbers when the water is clear and still, all crawling in one direction over some stretch of sandy bottom, and apparently migrating towards a more suitable locality. The deep-sea lobster rarely approaches within several miles of the coast. It is not much sought after by our fishermen, the water being too deep for the ordinary trap to be managed with profit. Cod-fishers sometimes pull them up on their hooks. When taken out of the water these lobsters soon become limp and torpid. The sunlight proves fatal to them in a few moments. Their shell is brittle, being composed largely of limy matter.

The natural food of the lobster consists of clams, mussels, and small shell-fish, for the crushing of which its two great claws are admirably adapted. The larger claw is furnished with what answers the purpose of molars in the higher animals, while the smaller one is thickly set with incisors, perhaps mostly used in dividing the softer portions of its prey; as the lobster never pursues anything capable of active flight,

prehension is certainly a secondary function of those claws. The only purpose they serve, besides that already described, is as weapons of defense or attack. The holes, scooped out from under shelving rocks, or excavated when the bottom is soft, often to a depth which is truly astonishing, are made in this manner. Having selected a spot, the lobster commences and carries out the operation solely by means of his tail, its great contractile power acting much the same as that of the human fingers would in a similar employment. The tail is slowly drawn up at first, taking as much of the mud as possible on its under side; then, when well under the body, a final, powerful jerk sends the mud or sand from out in front, and at the same time draws the lobster farther back into the cavity thus made, enabling him to get a better grasp for repeating the process over and over again, till by degrees he disappears from sight, and rests only when he finds his curious chamber sufficiently retired for safety or comfort. These holes are for the shelter of the lobster during the period of exuviation. As the shell of the lobster cannot increase in diameter, the creature soon grows too large for its coat, and some means must be provided to accommodate it to the increasing bulk of the body. This is effected by the yearly exuviation, or the throwing off of the old shell, and the formation of a new one. It should be remarked, however, *that full-grown lobsters are subject to no such change.* Professor Bell states that exuviation takes place annually until growth is completed, and alludes to his having seen the carapace of the living lobster covered with barnacles so large that several years must have been required for attaining their existing size. This statement of Professor Bell I have verified by observation. The season for casting the shell is generally from June to September. A lobster about to exuviate is readily detected by his sluggish movements and the dull red color of the membrane in his joints. He evidently feels sick, and sometimes takes refuge in mud-holes, sometimes under rocks, and often under a bunch of marine weeds. Usually in less than a week from the first indications, the process of working off the old integument is completed. It is extremely interesting to watch the performance. The shell inclosing the trunk splits down the back in a line always discernible as a faintly marked seam. It gradually falls apart, and is separated from the rings of the tail, but never from the covering of the legs or big claws, from which those appendages are slowly drawn, apparently with great pain and difficulty, and no wonder, since the bulk of the claw, immediately after its extraction, is out of all proportion to the diameter of the joint through which it is made to pass. But the fleshy part is very soft, almost semi-liquid, and can be compressed into small space. As the last act in the process, the lobster crawls forward feebly, leaving the shell of his tail behind him. For a few days he is almost incapable of motion, and not until his new shell, which is formed by a mucous exudation containing much cal-

careous matter, has assumed the normal hardness, is he reckoned fit for use as an article of food.

The faculty possessed by this curious crustacean for repairing injuries is very remarkable. Most curious of all is the power which the lobster has of casting off the entire arm when only the claw is wounded. This fact has never been sufficiently noticed. It would seem as if the new growth could only issue from the second joint from the body. Slight hurts received below that are commonly found healed over. When the injury is serious, the arm instantly snaps off at the second joint (where the diameter is the least), and this without any apparent effort on the part of the lobster—certainly not by "a violent muscular contraction, or by striking it against some hard body," as gravely set down in some work on natural history. I am inclined to think it may be due to something akin to the electric shock characteristic of some species of fish.

Progression is effected by means of the legs proper, which grow from the thorax. It is always a slow and crawling motion, during which the fan-like processes of the tail are expanded but motionless, the large joints of the arms are at a sharp angle, the claws slightly elevated, held close to the head, in such a position as to offer the least possible resistance to the water. The tentacles are continually moving from side to side, and in advance, as if to make sure of the road. Should danger threaten him in front, he beats a retreat with astonishing rapidity. He is great on taking back-water, for which he is admirably fitted by nature.

That lobsters have a very acute sense of smell is clearly proved by their being attracted from a long distance to traps that are well baited. If the bait is such as to give off particles abundantly, however fine, lobsters may be observed nearly a mile away, in the direction towards which the tide runs, making for the place where the bait is deposited. Traps also that are attached to a trawl-line, sweeping with a steady current, are never fished so well as single traps set in the same locality but *across* the tide. The reason is obvious. In the one case the scent goes out in a narrow trail, as from a single trap; in the other it is widely diffused. The use of the little protuberances, one in each transverse rib of the abdomen, has not been ascertained. I have been led to believe that they act as *prods* to hold the small shell-fish on which the lobster preys, and to draw more surely from the mud. The lobster, as before described, digs with his tail, which very handily wraps the bivalve partly round as soon as reached. Thus the little horns on the extremity of the tail are directly opposed to those near the thorax, and the prize cannot easily slip from the grasp.

The season at which the female lobsters carry eggs varies very much on different parts of the coast. Lobsters in Connecticut are with eggs in April and May. In Nova Scotia they have been found with eggs, in which the embryos were just beginning to develop, early in September; and in New Brunswick the female lobsters are full of spawn

by 1st September, the majority depositing in October. A corresponding variation is noticed in the lobster of the European coast. The eggs of the lobster, when extruded, are coated with a viscous secretion which thickens into threads, and causes the eggs to adhere to each other and to the fine hairs with which the swimmerets of the abdomen are fringed. I took the pains to count the eggs of a medium-sized lobster, and found the number to be over thirteen thousand. On certain parts of our coast scarcely a male lobster is taken, the catch being all females. I believe these to be the spawning grounds. In one such place, on the inside of Shippegan Harbor, where there is shallow water, and where only *female* lobsters are caught, no less than *seven* lobster factories were in full operation last summer! In Nova Scotia lobster fishing begins one month earlier than in New Brunswick. Last year the proprietor of a factory in this province set his traps on the 20th of April, keeping them baited, but caught nothing until the night of the 5th of May, when the lobsters suddenly "struck in" as plentiful as at any time of the season. With us lobsters become scarce about the 20th of August. *To this rule there are exceptions.*

As to whether the lobster beds are being depleted by the yearly increasing fisheries I am not yet able to determine. Certain localities may give out by a constant drain. Muddy bottoms, I believe, are not so well adapted for the breeding of the lobster as rocky coasts, the spawn being more liable to destruction by other fishes. The fisheries of Maine have failed, perhaps owing largely to this fact, though the business was prosecuted too extravagantly for many years. The following letter is from A. T. R. Freeman, a prominent dealer in Southwest Harbor, Me., and dated November 29, 1884:

"Replying to your letter of inquiry, bearing date of the 17th instant, I would say that the views of those interested in the lobster business here are so varied that it is difficult to arrive at a correct conclusion as to the cause of the decrease in lobsters. That they were becoming scarce was certain until the last lobster law was passed, providing for a close season between July 15 and November 1—covering the spawning season—and prohibiting the catching of any less than 9 inches in length during the rest of the year. I think the protection during the spawning season the most essential. Since the passing of this law, lobsters are on the increase; our fishermen report them in abundance again. It has been demonstrated that they are a school fish, similar in this respect to the herring and mackerel. They are more plentiful some seasons than at others."

I cannot ascertain that any deterioration in size or numbers has yet been noticed in Nova Scotia. A prominent lobster packer, who has fished for many years on our own coast, assures me that "lobsters are as plentiful as ever, but are *much smaller* than formerly." The supply of lobsters sent to market—chiefly to London—from the coasts of all parts of Britain has of late years greatly fallen off from over-fishing.

With reference to the quantity packed in the maritime provinces annually, I have ascertained that the product of 1884 will, in New Brunswick, exceed that of the previous year by 1,000,000 cans, that of Nova Scotia by 500,000, and Prince Edward Island by 500,000. Cases in which the lobsters are packed are made uniform to contain 48 cans. In New Brunswick five lobsters are *now* required to fill a pound can. From these facts there is only one reasonable conclusion to be drawn—that unless the lobster fishing is prosecuted under certain necessary restrictions—in our own province, at least—this valuable crustacean must soon be exterminated.

NATURAL HISTORY SOCIETY,
St. John, N. B., January, 1885.

22.—REPORT ON THE POLLUTION OF THE POTOMAC RIVER BY THE DISCHARGE OF WASTE PRODUCTS FROM GAS MANUFACTURE.

By MARSHALL McDONALD.

In compliance with instructions, based upon the request of Commissioner Edmonds, I proceeded on Saturday to make an examination of the river along the Georgetown front, with the view of determining:

1. The amount and nature of the waste products discharged into the river from the factories of the Washington Gas Company, and the establishments employed in converting their residual products into ammonia, &c.

2. The probable influence of such discharges in affecting unfavorably the conditions of life in the water.

I beg, respectfully, to report as follows:

(A) The waste products from the Georgetown gas works are all discharged, I am informed, into Rock Creek; no arrangements having been made by this company for the further conversion of any into useful matter.

(B) The establishment engaged in the conversion of the coal tar product from the Washington gas works discharges also a certain amount of waste into Rock Creek near its mouth. This discharge consists of water carrying in suspension a dark oily substance, which passes into Rock Creek either floating or in suspension; but seems to sink below the surface a short distance from the point of discharge. The amount of discharge from this source is probably 30 or 40 gallons a minute.

(C) I was unable to get information in regard to the nature and amount of product discharged from the ammonia works, the pipe leading into the river being carried down below low water mark.

(D) The main discharge into the river is, however, from the regenerators employed in the establishment for the manufacture of gas from oil; this gas being employed as an enricher of the gas derived from

coal. None of the waste products in this establishment are utilized, all being discharged into the river by a sewer at the foot of G street. The amount discharged is not less than 100 gallons per minute, and carries with it a considerable portion of the same oily residuum that has been already mentioned as coming from the establishment for the utilization of the coal tar products.

The characteristics of this substance are such that in the ordinary ebb and flow of the tides it must be very widely disseminated over the bottom of the river. As it comes from the sewer it seems to be lighter than the water, and floats off in a dark stream along down the shore. Agitated for a while by the rippling of the water, it sinks; this result being due either to the fact that the cohesion of the layer is broken, or more probably that becoming incorporated with the mud and sediment, its specific gravity is increased to such a slight extent as to be hardly appreciably heavier than the water in which it is floating. These peculiar characteristics must necessarily determine its general distribution over the bed of the river in front of Georgetown, and in a lessening quantity as far down as the limits of the District extend.

We are confronted, therefore, with the fact that this substance, so generally distributed over the bottom of the river, may and doubtless does influence unfavorably the conditions of life for all those minute forms which have their nidus on the bottom, and which furnish the substratum or basement upon which the existence of higher forms of life in the river necessarily depends. The abundant organic life which flourishes in the ooze upon the bottom furnishes the food of the minute forms which float or swim in the water above, and which, in their turn, furnish the food for the young of fish such as the shad, herring, rock, perch, &c.

It is evident, therefore, that even if the discharge of waste products, such as have been above enumerated, into the river should seem to have no injurious effect in driving the larger fish from the river, yet indirectly, by modifying unfavorably the conditions of the bottom, it may, by destroying their food, make impossible the development and growth of the embryo fish, which must be nurtured in this area in quantities sufficient to keep up the annual supply for the fisheries.

It is, in my opinion, absolutely necessary, in connection with the legislation now contemplated in reference to the fisheries in the District of Columbia, to prohibit absolutely, and under severe penalties, the discharge of gas tar or other waste chemical products into the Potomac. It is useless to protect the spawning of the shad and herring in District waters if we at the same time permit the conditions which determine a sufficient supply of food for them in the waters to be unfavorably influenced by the pollution of the stream by these products.

WASHINGTON, D. C., *May* 19, 1884.

23.—PROTECTING THE OYSTER BEDS FROM STAR-FISH DEPREDATIONS.

By Professor SAMUEL GARMAN.

[From the Boston Evening Transcript.*]

Among the causes which may be advanced to account for a decline in the production on the mentioned oyster beds are over-fishing, destructive modes of dredging, unusual deposits of sediment, depredations of enemies—such as star-fishes, shell-fishes, crabs, fishes, &c., and the disappearance of certain fishes which checked the increase of these enemies.

It is many years since the decline of the oyster industry, through impoverishment of the beds, attracted attention in Europe. The investigations of M. Coste and others fixed the blame neither upon marine enemies of the bivalve nor upon the elements, but upon the oystermen. Anxious for large catches, and careless of the future, they left few of the larger oysters on the grounds, and recklessly destroyed countless myriads of the young. Great heavy dredges were dragged through the beds, sweeping large areas, alike of the oysters and of places for the attachment of others, and leaving the spaces fit only for the occupancy of mollusks, worms, and other devourers. There is a limit to what can be taken from any colony of oysters. Yet what is of value for present consumption in the catch is as nothing compared with the immense rate of reproducing, and is very little indeed compared with the number of the young destroyed and the ruin wrought in the beds by the fishery. The evil is not so great here as it was across the Atlantic, yet it exists to some extent. Though the remedies are in their own hands, it is necessary here, as in Europe, for the legislature to protect the oystermen against themselves.

Destructive depositions of sediment on the beds are most often accidents, for which the only remedy appears to be planting anew.

Marine enemies of the oyster are numerous and very destructive; star-fish, "five fingers," are of the most dreaded. Employing a diver certainly would be one of the surest methods of getting at them in the adult stages. The idea is a good one; the diver would at any rate be the means of getting an accurate knowledge of the conditions of the colony, effects of dredging, &c., even if he should be able to do little more. May, June, and July are the best months for his work. The spawning time of the star-fishes is begun by one species late in July, and by another is made to last till the latter part of August. The young are not five-fingered,

* In answer to questions concerning destruction of Connecticut oyster beds; including "Can divers be worked with advantage on beds infested by starfish?" "Do menhaden eat starfish?" "What legislation would protect the oystermen from the 'pogy' fishermen?" etc.

hard, and confined to the bottom like the adult; they are transparent, exceedingly minute, and swim freely through the water. Coming to the surface by night they are carried about by the currents, and, unless the attack was a general one, the relief afforded a portion of the bed by the diver would only be temporary. One portion would soon be stocked again by another. It is after they have assumed the common form of star-fish that they are known to be so destructive. Oysters spawn in June, July, and August; they also are free to swim about after birth, but only for a day or two. It may be that while they are free and have no shells they are preyed upon by the jelly-like five-fingers, which swim about freely for a fortnight to three weeks.

It is well established by the researches of Professor Goode and others that menhaden ("pogies") do not eat star-fish in the adult form. Our foremost authority on the subject says of menhaden: "These fish do not feed upon living animals, and teeth would be useless to them." There is little doubt, nevertheless, that a considerable portion of the food of menhaden and kindred fish is made up of the jelly-like larvæ of radiates, mollusks, articulates, and worms, in the mastication of which teeth are unnecessary. It is likely the oystermen are right in saying menhaden are beneficial to them. It is unlikely that all of the captures of the fishermen have perceptibly lessened the numbers of these fish. Menhaden are supposed to spawn in midwinter, and the place is not certainly known; they are not subject to such danger of extinction as fishes caught at the time and place of spawning. Yet the weight of testimony goes to prove that pursuit by the fisherman has driven the menhaden away from the bays and inlets of the coast. They seem as numerous as ever some distance out, but they no longer sweep the mouths of the streams in such enormous schools as in former times.

The oystermen would do well to find out through the diver the exact condition of things on the beds. If he can work to advantage against the five-fingers, so much the better. It should be at once determined, from specimens caught on the spot, whether menhaden do eat larval star-fish and other enemies of the oyster. If so, legislation restricting the pursuit of these fish from the middle of July to the middle of September would include the time they would be of use against star-fishes. Before legislating, however, the thing to do is to determine accurately what enemies to check and what will check them.

MUSEUM OF COMPARATIVE ZOÖLOGY,
Cambridge, Mass., July 28, 1884.

Vol. V, No. 9. Washington, D. C. April 1, 1885.

24.—THE RATE OF GROWTH OF OYSTERS AT SAINT JEROME'S CREEK STATION.

By JOHN A. RYDER.

The following notes and illustrations may be of interest as showing the size to which oysters of an approximately known age may grow in a favorable situation within a comparatively short space of time. As already stated in former reports, it is not uncommon for spat to grow to the dimensions of 2 inches across in a single season.

The accompanying figures represent two specimens of oysters belonging to a lot which had attached themselves some time during the months of August and September, 1880, to collectors put down at Saint Jerome's Creek Station. The spat caught there that season on the slate and other collectors was detached and placed in a caisson to protect it from enemies, and left in the creek till 1882, when the writer in July of that year made some drawings of some of the oysters developed and protected as above described. This was approximately twenty-three months, or almost two years since the specimens had existed as free-swimming embryos in the waters of the creek.

In Figs. 1 and 2, the oysters, reared as above described, are represented. In both, the outline of the spat shell as it appeared at the end of the first year can be distinctly seen. In Fig. 1 this was about 1½ inches across at the end of the first year, when the growth of the shell was almost entirely suspended, but during the next eleven months the shells had been extended about 2 inches more from the hinge end, so that the growth made by the valves in two seasons had aggregated 3½ inches, reckoning from the hinge to the free borders of the valves opposite.

In Fig. 2 the rate of growth, it will be seen, was not so rapid during the second year, only about an inch more having been added during the second year to the extent of the valves of the spat shell of the first year, so that the rate of growth of the first and second seasons was about equal, the total length of the specimen being 2¼ inches.

Upon opening the specimen shown in Fig. 1, it was found in spawning condition at the time, or about the middle of July, 1882.

The change from the condition of attachment of the whole under surface of the whole lower or external face of the under valve after the first season's growth is abrupt; the edges of both valves, as the second year's growth of the shell is extended, are at once turned upwards obliquely to the plane of the surface of attachment, and thus freed, as may be plainly seen when the specimens figured here are viewed from the side.

These specimens are fairly representative of the late of growth of oysters in the coves along the Chesapeake, where the growth and multiplication of microscopic organisms is greatly favored. The growth of spat in more saline waters than those found in the best coves of the Chesapeake does not seem to be so rapid, but the number of individual

FIG. 1.

FIG. 2.

Figures illustrating the rate of growth of oysters in Saint Jerome's Creek.

young oysters which set or become affixed seems to be relatively much greater. The take or set of spat in the best oyster coves or creeks does not seem to be generally so abundant, yet its growth, as the specimens figured show, is very rapid, far more so than that of the smaller, viviparous European edible oyster, but about equal to that of the oviparous Portuguese species.

WASHINGTON, D. C., *January* 29, 1885.

25.—REPORT OF A TRIP TO LONG ISLAND IN SEARCH OF SKELETONS OF THE RIGHT WHALE, BALÆNA CISARCTICA.

By FREDERICK W. TRUE,

Curator of Mammals, U. S. National Museum.

[From a letter to Prof. S. F. Baird.]

Following your instructions I went to Southampton, Long Island, on the 30th of January, to find out whether it would be possible to procure for the Museum the skeleton of one of the four whales reported to have been recently captured near that place. Upon arriving at Southampton, I found that the newspaper accounts were substantially correct and that four specimens of the Atlantic right whale (*Balæna cisarctica*) had been captured. The carcasses lay on the beach at the following points. One near Bridgehampton, one 3 miles east of the Southampton life-saving station, one 2½ west of the same, and one near the Amagansett station. The first was said to be a male and the others females. An agent of Mr. Ward's arrived at Southampton and took possession of the skeleton at Amagansett, and I did not therefore go to examine that specimen. I examined both of those near Southampton. The skull of that to the west had been hacked in pieces with axes and various parts were missing, so that it was of no value. The skull of the specimen lying to the east of the station I secured, but the skeleton had been washed out to sea. This specimen was not so large as some of the others, but the skull is in a good state. The latter is about 10 feet in length. I secured also a slab of whalebone through the kindness of Captain Herrick, who threw the fatal lance. The Bridgehampton specimen I could get no certain information about, and considering the condition of the others did not deem it warrantable to go to further expense.

The spoils of the expedition are, therefore, a skull, an eye, a slab of whalebone, and the "bonnet." The skull will be forwarded as soon as it is ascertained by what route it can be most economically sent.

Mr. Nelson Burnett, keeper of the Southampton Station, and his men

gave me valuable assistance. More whales have been seen on the coast, and we may yet succeed in getting a complete skeleton. I would suggest that it might be desirable to send a printed circular to the Long Island keepers requesting them to give the matter their special attention.

WASHINGTON, *February* 5, 1885.

26.—NOTICE OF THE CAPTURE OF A MALE PYGMY SPERM WHALE—KOGIA BREVICEPS—AT KITTY HAWK, NORTH CAROLINA.

By FREDERICK W. TRUE.

The Commission may well congratulate itself upon the receipt by the Smithsonian Institution of a male pygmy sperm whale. The occurrence of this rare and interesting species in the Atlantic was made known for the first time by the capture of a specimen somewhat more than a year ago at Spring Lake, New Jersey. This first specimen was a female, and one can, therefore, understand the gratification those interested in the study of the Cetacea feel in receiving, as a second specimen, one of the opposite sex. The species is by no means well known, but of the few specimens captured the majority have been females. If I am not at error in my opinions, the male has been described as an animal of a genus and species distinct from the female.

The circumstances which attended the acquisition of the new specimen are set forth in the following letter addressed to Professor Baird by Mr. James R. Hobbs, keeper of the Kitty Hawk Life-saving Station, Sixth District, North Carolina, and dated January 1, 1885:

"I am sorry I was unfortunate with the fish, but I was determined to secure it. It came ashore during a gale of wind and a high tide and was badly chafed. On the next morning we had a snow storm. The fish came ashore 2½ miles north of the station, and the patrol informed me that it was a porpoise. Accordingly, I sent three men with horse and cart for it, but as one of them had to hold the horse and the other two could not put it in the cart, they returned without it, and reported that it was a blackfish 9 feet long. The men pulled the fish upon the shore, and I had it covered with a light sail. On Sunday the gale abated, and I succeeded in carrying home the fish, which I identified as a pygmy sperm whale. While the whale was on the beach the sail blew off of its head, and the birds picked out one of its eyes. I did not get your telegram until the afternoon of Sunday. The gale detained the boat that runs here, so I boxed the specimen up and carried it in a small boat a distance of 5 miles to a fish-boat, and shipped it to Elizabeth City. I hope you will receive it all right. Like all other fish of its kind, handling causes the skin to peel off as the skin of a potato. This whale was badly skinned up.

"Surfman T. N. Sundlin (No. 5) found the fish. All of the labor has been done free of cost.

"I am an old sailor, and have been in nearly every sea, excepting the Arctic Ocean and the Red Sea. I am well acquainted with fish, but have never seen a bone-shark on this coast, though there may be some. But I have caught in my bluefish nets hundreds of switch-tails and man-eaters, as the sailors call them."

The specimen which we owe to the enterprise of Mr. Hobbs and his crew is about 9 feet in length, and appeared to be adult but not old. The skin as he states was badly abraded, and hence it was impossible to determine its original color. Two characters of the specimen attracted my special attention. In the upper jaw near the anterior end were four slender curved teeth, similar to those of the lower jaw, but smaller. These did not occur in the female previously received, but two teeth were said to be found in a similar position in a specimen from India, described by Sir Richard Owen* under the name of *Euphysetes simus*.

On account of the presence of teeth in the upper jaw, and in consideration of the presence of some other apparently important characters, Dr. Gill erected a separate genus, *Callignathus*, for the specimen in question.†

After an examination of the type specimens and study of the literature, however, I am inclined to agree with Professor Flower that the specimens thus far acquired represent but a single species which is probably cosmopolitan in range.

The second character which attracted my attention upon making a preliminary examination of the specimen was the peculiar position of the genital opening. This orifice is situated anterior to the line of the front margin of the dorsal fin, while in the dolphins I have examined it is almost as near the vent as the same opening in the female.

The stomach contained only the beaks and eyes of cuttle-fish and a great quantity of nematoid worms. A large number of larval cestoid worms, apparently of the genus *Phyllobothrium*, were found encysted in the integuments of the back, especially about the dorsal fin.

It is my intention to publish a somewhat extended account of the genus *Kogia* as soon as circumstances permit. A considerable number of specimens of the genus have been accumulated in different parts of the world. It appears to be somewhat common about Australia. The type-specimen described by De Blainville is in the Museum d'Histoire Naturelle, Paris. The National Museum possesses, in addition to the male and female mentioned above, a fœtus, and a mandible from Mazatlan (type of *K. Floweri*).

UNITED STATES NATIONAL MUSEUM, *January* 19, 1885.

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*Trans. Zöol. Soc., London, vi, 1866, pp. 87–116.

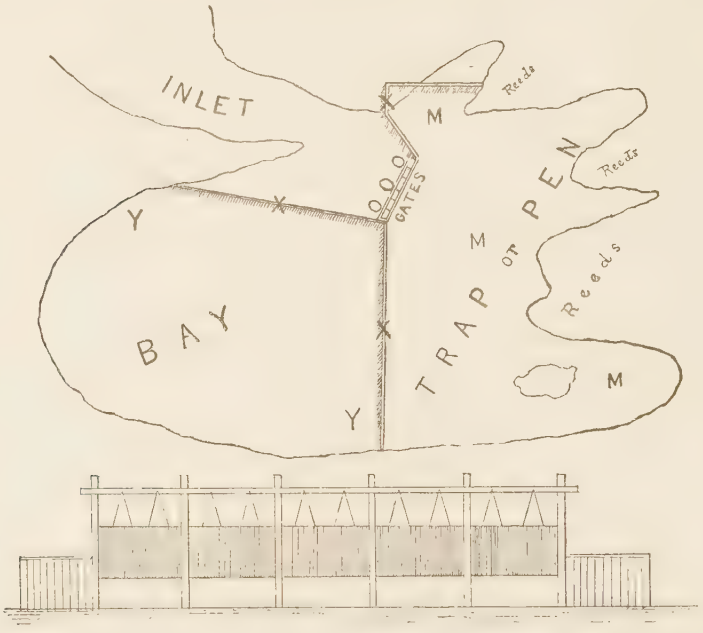
†Amer. Naturalist, iv, 1871, p. 16.

27.—DESCRIPTION OF A FISH-TRAP AND OYSTER BASIN.

By J. W. de POINCY.

[From a letter to Prof. S. F. Baird.]

On my Amenencourt place, where I live, I have a small land-locked bay of several acres' area, that I have utilized nicely as a fish-trap and



oyster park, merely, however, for my own use. The fence X X X is only useful in keeping the fish out of the deeper parts, Y Y, of the bay, and in forming a passage-way to the gates O O O, that, being shut or lowered at high tide, keep the fish that have entered the pen or trap M M M from returning or escaping; and as the interior of the trap is bare at low water, the fish caught are left high and dry. This arrangement furnishes me, at little expense and trouble, all the fish-food wanted. Mullets, pompanos, red bass, snappers, young drum, sheepshead, and crevallés are the chief kinds caught. As the bottom of this bay is very muddy and soft, something for the oyster spat to grow on is imperatively necessary, and for this purpose I have put down many pegs or small poles, and also scattered about thousands of oyster shells. I think that the floating spat will cling to and grow upon these objects, and so produce fine oysters. The sheltered location, protected besides by the fence X X X, should prove an admirable situation to carry on the business. I have only lately begun this oyster farming, and am not yet able to give any definite information concerning the success of my plan.

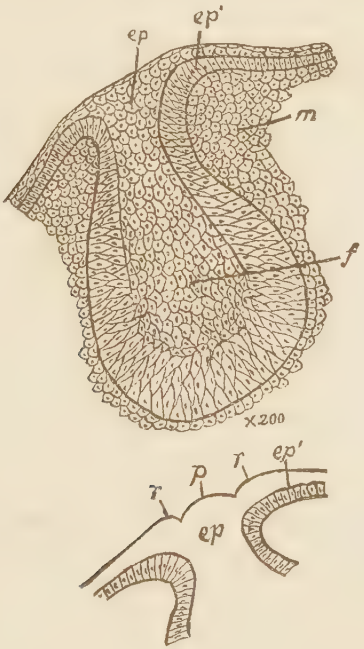
MANATEE, FLA., *October* 8, 1884.

28.—ON THE DEVELOPMENT OF THE MAMMARY GLANDS AND GENITALIA OF THE CETACEA.

By JOHN A. RYDER.

The opportunity to dissect a gravid female of *Phocæna communis* having recently presented itself through the great liberality of the Director of the U. S. National Museum, Professor Baird, the dissection being in part conducted by my friends Mr. J. L. Wortman, of the Army Medical Museum, and Mr. F. W. True, curator of the Department of Mammals in the National Museum, I availed myself of the opportunity to make an examination of the structure and condition of the mammary gland of the adult, which contained a fœtus in its uterus about a foot long.

This specimen became of still greater interest when I subsequently happened to be fortunate enough to obtain excellent sections of the



EXPLANATION OF FIGURES.

Upper figure: Vertical section through the rudiment of the mammary gland of *Globiocephalus*, enlarged 200 times. *ep*, outer layer of epidermis; *ep'*, deep or Malpighian layer of the same; *f*, cellular mass in the center of the glandular rudiment derived from the outer layer; *m*, mesoblast or connective tissue.

Lower figure; A similar section, but drawn diagrammatically through the incipient nipple *p* and folds *r r* which inclose the former, finally giving rise to the walls of the mammary fossa and growing up over the nipple so as to conceal it from without at a very early stage.

first traces of the mammary gland in a very young female fœtus of the blackfish, *Globiocephalus melas*, about 2 inches long, the rudiments of

the glands being present on either side of the vulva as simple pyriform involutions or thickenings of the epidermis, as shown in the accompanying cut, drawn from a section passing vertically through the largest portion of the mammary involution and enlarged 200 times.

The primary epiblast, which gives rise to the epidermis *ep*, and the deep layer of the epidermis or *stratum Malpighii ep'*, which forms a solid involution several cells deep at its fundus, is clearly the layer from which in the Cetaceans, as in man, the primary acini, or mammary follicles, are budded off. An involuted mass of cells, *f*, are continuous apparently with the epidermis *ep*, but this mass is not sharply delimited at the fundus of the involution from the *stratum Malpighii*. The latter, however, at the mouth of the involution is quite sharply defined, as indicated in the figure, and differs in this regard from the condition of affairs presented by a section through the mammary gland of a male human fœtus of five months given by Kölliker (11); but Huss (5) figures a stage of the human mammary gland in which the Malpighian stratum is almost as well defined as in my sections of the rudimentary mamma of the embryo of *Globiocephalus*.

The evidence is quite conclusive, so far as the development of the mammæ of *Globiocephalus* afford us any insight into the mode in which these structures are formed in the Cetacea, that the latter differ in no very essential respect in the mode of the early development of these organs from other mammals.

While it is true that I am enabled to figure but one stage, it is unquestionably a fact that that phase is approximately equivalent to the five months' condition of the same organ in a human fœtus. It now presents the form of a simple epiblastic involution or a pyriform proliferation of cellular elements, which have been derived, as shown by their connections, from the epiblast or fœtal epidermis, and this structure has been gradually developed from a simple thickening at *ep*, which has extended downwards into the indifferent surrounding mesoblast *m*, or connective tissue, from the superficial part of which the corium would be formed at a later period.

Of anything like buds from the lower end of this mammary involution, which would represent the future acini or subdivisions of the mature gland, we see nothing, but that such are developed later there can be but little doubt, and in a manner simulating that figured by Kölliker (11) as characteristic of the seven months' human fœtus, the actual terminal subdivision of the ends of the primary acini not occurring in the human species until the time of birth (Langer, 4), when they contain the so-called witch's milk—*Hexenmilch* (D. Barfurth, 10).

In one important respect the later development of the acini of the mammary gland of Cetacea would doubtless differ from that of other mammals, namely, in the rate at which the anterior and posterior acini and the lateral acini would grow, the former being much longer than the latter on account of the elongated, flattened form of the whole gland

(Solley, 3; Owen; Cooper; Hunter, 1; Geoffrey St. Hilaire; Rapp; Rudolphi; Turner). It is therefore likely that the anterior and posterior acini would be developed most rapidly and become longest, and not present nearly so uniform a length and such a pronounced radiated arrangement as in most other Mammalia, in which the gland is discoidal and more or less conical, but resemble to some extent, at one stage of development, the unspecialized condition of the organ seen in *Echidna*.

But the preceding may perhaps be considered pure speculation, and possibly quite out of the way so far as it is intended to describe the mode in which the adult gland is formed. The latter has long ago, as described by Hunter, Cooper, and St. Hilaire, a large ampulla or lacteal sinus, which traverses its center longitudinally along its middle. The involuted rudiment which I have figured may send out two great processes from its enlarged end, an anterior and a posterior one, from the sides of which the secondary acini of the adult gland may bud out laterally on either side. This is the more probable mode of development, for we find that the subsidiary lateral ducts open at intervals into the median lacteal sinus, along the sides of the latter, in the adult organ.

The coarse anatomy of the adult mammary gland of *Phocæna* is pretty well known, and it will therefore be superfluous to enter into a very detailed account of the organ. It is a flat glandular mass nearly 3 inches wide, somewhat over a half inch thick in its center or in the region of the nipple, and nearly or quite a foot in length. Externally or ventrally it is invested by connective tissue, and overlaid first by what are apparently dermal muscles and then by the tough, fibrous, skin which is not underlaid by blubber here or in the vicinity of the vulva. The nipple opens from the mammary sinus and is placed below the hinder half of the gland. As in *Balænoptera* (Turner, 12), there is a single opening in the nipple, the numerous orifices in it described by Owen being apparently the pedunculate bodies at its tip figured by Turner, and, as surmised by Gegenbaur (6), do not indicate the existence of numerous milk ducts opening on its apex.

The apex of the nipple in *Phocæna*, unlike that of *Balænoptera*, is quite smooth, somewhat flattened laterally by compression between the folds of the external mammary fossa, and shows a very distinct single terminal opening in its center, which is continuous by way of a single canal with the wide mammary sinus below.

From the description given by Turner of the enormous mammary gland of a gravid specimen of *Balænoptera*, the inference may be drawn that there is but little difference between the structure of the mammary organs of the *Denticete* and the *Mysticete*.

In both there seems to be good reason for believing, with the editor of the posthumous edition of Hunter's paper (1), that the milk accumulates in the great mammary sinus and is rapidly forced out by the volition of the mother, by compression through the action of the overlying

muscles, while the calf has its mouth to the nipple, for only short intervals between the times when it rises to the surface for air.

The peculiar position of the nipple, which is sunken into a longitudinal fossa which quite covers or incloses the former, is a characteristic feature of the external conformation of these organs in the Cetacea, and may be regarded as a physiological adaptation similar in nature to the extension and flattening of the gland itself, as a result of which the milk-secreting organs do not bulge outwards as in other mammals, but helps the animal to retain its normal fusiform shape, with no portion of these secondary sexual organs projecting outwardly, thus protecting them from injury and not impeding the movement of the parent through the water, as suggested by Owen.

The question now arises, to which category the mammary gland of Cetaceans must be assigned, namely, those with true nipples, such as are found in the Carnivora, or those with pseudo-nipples, such as are found in Ungulata, certain Marsupialia, and Murina. To judge from the structure of the adult nipple, with its single opening, there can, I think, be little doubt of the propriety of classing the mammary gland of Cetacea with that group which has been characterized by Gegenbaur (6) as possessing pseudo-nipples, which are developed by the production of the margin of the primary mammary area of the embryo into a tubular prolongation, and which in all cases is characterized by the possession of a single external opening, as in the cow. By what process of development, however, the great median sinus of the Cetacean mammary gland was produced we do not know, and must wait for the elucidation of this part of the subject through the study of more material.

Turner (12) speaks of the sinus as being lined by a mucous membrane, but the question arises, has this endothelial lining of the gland arisen by involutions from the primary epiblastic involution, or has it arisen partly by vacuolization and retrogressive histological processes, as argued by Creighton (7) and Rein (9). To me it seems probable that both processes, as shown by the last-named investigator, are involved, namely, those of involution or proliferation from the primary gland bud, and vacuolization, which latter process probably steps in later, or after the foundations of the principal acini have been laid down by the first process.

In some forms it would seem probable that the mammary glands almost wholly disappear during the intervals between the periods of gestation, as observed by Allen (8) in the bats, to be regenerated again beneath the integument with the progress of the period of gestation. Facts such as these would seem to favor the opinions and suggestions put forward in 7, though there can be no doubt whatever as to the fact that the first traces of these organs exist as thickenings or proliferations at definite regions in the epiblast, and that eventually such a thickening shoves the *stratum Malpighii*, downward before it as a pretty

well defined layer into the mesoblast, as shown in the accompanying figure.

The development of the dermal folds which inclose the nipple of Cetaceans, however, complicates the development of the nipple itself somewhat, so that it is probably impossible at present to reach any very positive conclusions, unless we may assume that the stages of the development represented by an embryo of *Globiocephalus melas* 2 inches long and one of *Rhachianectes glaucus* 5½ inches long will serve to throw some light upon this question.

The sections which were made of the young of *Globiocephalus* of the size mentioned show that the folds which form the wall of the nipple fossa were only in their incipiency or scarcely at all developed during the 2-inch stage, as shown in the second diagrammatic figure, taken from a section at a somewhat different level from the upper more detailed one, this one striking nearly the center of the incipient nipple, which seems to be present as a slight elevation of the epidermis, while on either side of it there are two swellings, *r r*, which seem to me to represent the developing side-walls of the nipple fossa.

What convinces me that the preceding opinion is justified is the external appearance of the nipple fossæ or clefts in the more advanced, female embryo of *Rhachianectes*, 5½ inches long. In this specimen the mammary clefts, without externally visible indications of the nipples, are already formed as a pair of minute longitudinal slit-like depressions, which, without much doubt, represent the proportionally large clefts which open from without into the nipple fossa in the adult. In this last stage these clefts are about .5 millimeter in length, and, on account of the greater proportional size of the clitoris of the embryo, are placed relatively much closer to that organ than in the adult. Were it possible to investigate the condition of the mammary gland in this larger embryo, it might be that light would be thrown upon the steps by which the gland itself is formed; but as the specimen is a unique one, having been figured by Scammon, and unfortunately belongs to a Pacific species which I am told by Mr. Dall is rapidly approaching extinction, great hesitancy has naturally been felt by the Museum authorities as to the desirability of sacrificing it for purposes of anatomical investigation.

There seems to me, therefore, to be but little doubt remaining that the nipple fossa of Cetaceans is developed during a comparatively early stage, or in the interval in the history of the intrauterine growth of the young Cetacean corresponding to that between the fifth and seventh months of the human fœtus.

Turner (12) has described rudimentary mammary fossæ, behind and a little to either side of the base of the penis of an advanced male fœtus of *Balænoptera Sibbaldii* 18 feet long, but in the much younger stages of development of *Phocæna communis*, represented by a male fœtus 3 inches long now in my hands, I cannot find any evidence of such rudimentary mammary clefts or fossæ as are described by Turner.

In a male fœtus of *Delphinus Bairdii* 11 inches long, belonging to the National Museum collection, no traces of mammary fossæ could be found. In another female fœtus in the collection, identified with some doubt by Mr. True as *Phocæna lineata*, and 17¼ inches long, the mammary clefts were 8 millimeters long, the nipples distinctly developed and about 1.5 millimeters in diameter.

In a male fœtus 33½ inches long, referred to *Balænoptera musculus*, (No. 13763) by Mr. True, the rudimentary mammary clefts are about one-eigth of an inch long, and are situated about half way between the anal opening and the proximal part of the preputial membrane covering the base of the penis behind, and seven-eighths of an inch in advance of the anus. The nipples are not nearly so well developed in proportion as in the female fœtus of *Phocæna* 17½ inches long, being only .75 millimeters in their longest and .5 millimeters in their shortest or transverse diameter. The pair of mammary clefts and nipples of opposite sides in this specimen were situated about one-fourth of an inch apart, measured across the middle line of the fœtus.

It is therefore evident that there is an important difference existing between the fœtal males of some of the species of *Denticete* and some of the *Mysticete*, inasmuch as the latter possess rudimentary mammary glands and the former do not. How universally this may be true we will not know until fœtuses of all the farms have been studied.

The sexes of young Cetaceans are already distinguishable when they are about 2 inches long, and when 3 inches long the genital raphe has closed in the male and the perineum is already much longer than in the female fœtus; it is, in fact, more than twice as long in a male 3 inches long than in a female fœtus 2 inches in length. It is therefore evident that the indifferent-stage development of the external genitalia of the embryos of Cetaceans must be passed over before they have reached the length of 2 inches, so that the dimensions reached when the sexes become differentiated externally probably correspond pretty closely with those of the embryos of the human species.

Wyman, in examining an embryo of the great right whale, *Balæna mysticetus*,* found it difficult to discriminate the sex of it externally, although 6 inches in length. In the series of embryos in my possession there does not seem to be any difficulty of this sort, as the single male specimen of *Phocæna*, with its closed raphe between the penis and anus, at once gives the unmistakable outward indication of the sex to which the specimen belongs.

This was an important matter to determine in order to discriminate the specimens used in the preceding discussion of the development of the mammary gland.

The results arrived at in the foregoing paragraphs may be summarized as follows:

1. The mammary gland of Cetaceans develops from a thickening of

* Proc. Bost. Soc. Nat. Hist., iii, 1848–'51, p. 355.

the epidermis of the embryo, which is covered internally by the *stratum Malpighii*, as in other mammals.

2. The acini of the gland probably develop in the same way as in the same organ in other mammals, except that the gland begins to elongate very early and develop a great longitudinal median sinus in its middle portion, which is directly continuous with the duct which opens through the nipple.

3. The folds which surround the nipple fossa and inclose the nipple arise very early, as shown by the condition of the gland in two successive stages represented by an embryo of *Globiocephalus* 2 inches long and one of *Rhachianectes* 5½ inches in length.

4. The gland as found in Cetacea, while displaying peculiar teleological modifications, must, so far as the mature anatomy and early development of the organ is concerned, be included with the type defined by Gegenbaur as possessing pseudo-nipples.

5. The sexes of Cetacean embryos, judging from those of *Globiocephalus* and *Phocæna* may be discriminated from each other externally when somewhat under 2 inches in length, by the differentiation of the external genitalia.*

In conclusion I would express my appreciation of the kindness of the curator of the Department of Mammalia in often, finding for me, I fear, at considerable trouble to himself, the materials, in the way of specimens and literature in the Museum collection, upon which this investigation is based.

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* I have not been able to find any papers dealing with the development of the mammary glands of Cetacea, though a thorough search of the literature may reveal the fact that such investigations have been previously made. The results which I have obtained have seemed to me of sufficient interest to warrant their publication, aiding as they may in giving us some additional light in a department of vertebrate embryology in which it is very difficult to obtain fœtuses young enough for the prosecution of such studies.

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29.—THE EFFECTS OF AN ELEVATED TEMPERATURE ON FISHES.

By FRANCIS DAY.

In a stream in the Government gardens at Ootacamund, on the Neilgherry Hills, in Madras, in the middle of December, 1866, the average maximum was 72°, the average minimum 50°, the highest point noted 72°, and the lowest 42°, and here Indian carp thrive. In the lake in that station, 7,600 feet above the sea, between May 20 and June 12, 1866, I found the water at 6 a. m. 67½°, at midday 77°, at 4 p. m. 79°, and at 6 p. m. 73°. In the Coonoor Stream the water was from 3° to 6½° colder than in the Ooty Lake, while half way down to the low country, at 4 p. m., it stood at 74°, and 6 p. m. at 75°. In the Bowany River, in the low country, a much higher temperature prevailed, at 6 a. m. it being 79°, at 12 a. m. 92°, at 4 p. m. 86°, and at 6 p. m. 82°. But after the first burst of the monsoon the water may be roughly said to have decreased about 10° in the Ooty Lake, 1° or 2° in Coonoor River, rather more on a lower level, but from 10° to 13° in the Bowany River. All these localities being stocked with fish, it shows that they must become accustomed to a heat which rises to as much as 92° at midday in the low-country river.

In June, 1869, I took sixty-three observations in the Irrawaddi River, in British Burmah, the thermometer being immersed 1 foot below the surface, and the temperature recorded between 6 a. m. and 11 p. m varied from 82° to 85°, while at the Een-gay-gyee Lake, on June 18, the water at 11 a. m. stood 90°. It is stated in Nature of February 12 that the secretary to the National Fish Culture Association at South Ken-

sington selected certain fishes for experimentalizing as to what temperatures they could survive in. All were first deposited in water registering 53°, which was gradually increased by the infusion of hot water through a tube, which caused the temperature to rise steadily. The rapidity of this rise is not given. We are told that none of the fish exhibited signs of failing vitality until the thermometer recorded 82°, when a perch became prostrated, and shortly afterwards its congeners followed its example in rapid succession in the following order: Roach, 82½°; salmon, 83°; minnow, 85°; gudgeon, 85½°; dace, 86°; tench, 88°; carp, 91°. Brandy is stated to have restored them all except the dace, which died. Whether further notes of these fishes have been kept, and if any more have succumbed, it would be interesting to know; but none of the temperatures appears to have reached what is normal for fish in India at certain seasons.

Dr. John Davy in 1853 made some very interesting observations on the above subject of temperature on ova and young fish, in each instance the experiment being carried on in a thin glass vessel of the capacity of about four ounces, nearly full of water, and this vessel was placed in a water bath of the temperature required. An ovum was two and a half hours in water at 70°, which rendered its circulation languid; kept two hours more, and increasing the heat of the water to 80°, no further apparent ill effects were seen. The vessel was now removed from the bath and allowed to cool gradually, and ten hours later a vigorous young fish was found to have burst its shell. An ovum and a young fish were kept in water between 68° and 72° for about eight hours, when the egg was found to be hatched and a tolerably active young fish was produced. Next day both were exposed to a temperature between 70° and 80°, rarely reaching 80°, and at the end of the day they were languid, or, if in motion, disposed to irregular movements. Removed from the water bath, the next day they were active, and subsequently showed no ill effects from their treatment. A young fish and an ovum were put into water raised to 82°, and after an hour to 85°, when the water was gradually cooled; but the circulation in the young fish was found to be languid, and the following day it was dead. The egg did not suffer materially for three days; subsequently a vigorous young fish was produced. An ovum kept in water for two hours at from 90° to 95° died, as did also one put for half an hour in water at 100°.

A young fish was kept three hours in water, commencing at 70° and gradually increased to 85°. The heart was then acting with tolerable vigor, and the following day the fish appeared to be nearly in its usual state, and five days subsequently it was tolerably active. A young fish kept in water at 84° was found to be dead, and to be sure that the result was not owing to a want of air in the water the experiment was repeated in the same water when cold, without injurious results. Another young fish was kept in water three hours and a half, rising from 78°

to 91°, without bad effects, while another two hours and a half in water between 88° and 90° died. One kept a few minutes in water at 92° seemed to be dying when removed, and appears to have died in about a quarter of an hour. Another was kept three hours in water gradually rising from 78° to 88°. At 85° the heart was acting, but no circulation was perceptible in the tail; at 88° it died. Dr. Davy has recorded many other experiments on this subject, as well as on the degree of temperature fatal to fishes.

In August, 1882, he placed a common trout of about a quarter of a pound weight into a good volume of water at 62°, which was pretty rapidly raised to 75° by additions of warm water, when it became very active and tried to leap out. In an hour the temperature was increased to 80°, and after a few more minutes to 85°, when it became convulsed, and, although transferred to cool water, died. When the water had sunk to 70°, smaller trout and a minnow were put in, and although the next morning the temperature had sunk to 67°, the trout was dead, but the minnow had not suffered.

A parr of the salmon was similarly treated, the water in half an hour being raised from 60° to 70°, and now it tried to escape. The water was raised to 80°, and it became torpid and convulsed; at 84° it seems to have died.

A char of about the same size had the water gradually raised to 80°, when it seems to have died. The trout tried to escape by leaping out of the water, while the char kept to the bottom, with its head downwards, as if seeking for a cooler locality. A small perch was put into water at 83°, falling in fifty minutes to 80°; after two hours it was found dead.

A minnow was put into water at 92°, and in less than two minutes it had turned on its side; but the water falling to 90°, it recovered, resuming its natural mode of swimming. A gold carp was put into water at 96°, but at once became restless. After a few minutes the temperature had fallen to 94°, and it remained motionless; now transferred to water at 70°, it rapidly revived. After about an hour it was placed in water at 93°, which at first it bore with, then became languid; but as the water cooled it revived, and at 88° it resumed its natural position.

A common carp was placed in water at 60°, raised in five minutes to 78°, and in twelve more to 80°; after another half hour the heat was suddenly increased to 85°, but it became languid, so it was allowed to cool to 80°, when it seemed to revive, so the heat was increased to 95°, and as it appeared as if dead, it was lifted into cool water, where it slowly recovered its powers. Other similar experiments on the loach and the eel were made.

CHELTENHAM, ENGLAND, *February*, 1885.

Vol. V, No. 10. Washington, D. C. April 25, 1885.

30.—THE RED SNAPPER GROUNDS IN THE GULF OF MEXICO.*

By Capt. J. W. COLLINS.

[From a letter to Prof. S. F. Baird.]

It may interest you to learn that on our way from Tampa to Tortugas we found red snappers much more generally distributed and seemingly far more abundant than they are on the fishing grounds farther to the northwest, where the fishery is now carried on. These grounds, lying between Tampa and the Tortugas, outside of a depth of 20 fathoms, have never been resorted to by the fishermen, so far as I have been able to learn, and their investigation I have deemed a matter of the highest importance to the fishing industries of the South. In a word, I think there is no doubt that we have discovered new grounds that are unusually rich in fish life, and particularly in the undisturbed abundance of red snappers. So far as our investigations extended, fish were found most plentiful in 25 to 27 fathoms of water, but seldom outside of the greater depth. In one instance, yesterday morning, a little after sunrise, we struck a school where we caught snappers "pair and pair," and so very plentiful were the fish that they actually came up to the surface near enough for us to see them over the ship's side. We caught only a few, since we had enough for the ship's use, and it would have been purposeless cruelty to catch fish that were not wanted. I believe, however, that a smack might have taken a full fare in this locality.

I am glad that the Lookout is on the Florida coast investigating the spawning fish. Should she stay late enough, I hope something may be learned of the breeding habits of the red snapper, the number of eggs it has, &c. This seems important, and a matter well deserving the attention of the United States Fish Commission, since it is probable, at least, that this species is being more or less rapidly depleted, and the day may not be far distant when the services of the Commission will be needed to keep up the supply, if not to prevent the practical destruction of the important fishery now prosecuted for the red snapper.

It is a matter of some regret to me that there has been no good opportunity to test the gill-nets and trawl-lines. It would have been interesting to have made trials with these under favorable conditions, so

*The steamer Albatross left Washington January 3, 1885, and returned April 6. The vessel made two separate trips from Pensacola to the Red Snapper Grounds. This is the first Governmental effort to examine the off-shore fishing-grounds of the Gulf of Mexico, and the success obtained justifies the claim that, by means of such a vessel, new fishing-grounds might undoubtedly be discovered which would add materially to the resources of the country.—EDITOR.

that definite ideas could have been formed of what might be accomplished by using them. I am satisfied, however, that, so far as the prosperity of the fisheries is concerned, little could have been gained of practical value. The fact that red snappers are gregarious in a marked degree, congregating in schools of limited extent on small patches of bottom, and the additional fact that they bite a hook with the utmost eagerness, makes it possible to capture them more readily and easily with hand-lines than in any other way. And when we consider how trifling is the expense of fitting with hand-lines compared with other forms of apparatus, it will be seen that there is little probability of the old methods being superseded, particularly when enough are caught now to make a serious drain on the resources of the fishing grounds.

KEY WEST, FLA., *March* 20, 1885.

31.—OPINIONS CONCERNING THE DESIRABILITY OF A HATCHERY FOR SALT-WATER FISH IN NORWAY.*

By H. RASCH, A. LANDMARK, and G. O. SARS.

OPINION OF PROF. H. RASCH.

The cause of the steady decrease of fish on the coast of Arendal, which has been noticed during the last few years, is undoubtedly excessive fishing. It will appear improbable to most persons that fisheries such as have been carried on in the Arendal district should have had an injurious influence on so fertile a fish as the cod, each healthy female of which contains several millions of eggs; but since the investigations of Professor Sars have taught us the conditions necessary for impregnating the roe of the cod, we can easily understand that if there are not a large number of male fish on the spot when the female fish eject the roe, the greater portion will not become impregnated.

The best remedy for this lack of spawning fish is, as far as I can see, artificial impregnation, by which all the roe becomes impregnated, whilst at the same time one can transfer the roe to localities where it and the newly hatched fish are protected against their enemies.

There is no doubt that in this way young fish can be produced by the million; but this is not sufficient. The growing fish must not be caught before they become fit for food. I therefore entirely approve of the measures proposed by Captain Dannevig for the Arendal district.

CHRISTIANIA, *October* 31, 1882.

OPINION OF MR. A. LANDMARK.

Owing to the steady decrease which has been generally noticed of the common salt-water fish in many places on our coasts, and especially

* From a pamphlet entitled Indbydelse til Tegning af Bidrag til en Udklækningsanstalt af Saltvandsfisk efter amerikansk Mönster, samt Erklæringer i Anledning af samme. Arendal, 1884. Translated from the Danish by HERMAN JACOBSON.

in the neighborhood of Arendal, Captain Dannevig has requested me to give my opinion whether this deplorable state of affairs can be successfully remedied by means of the artificial hatching of the roe of cod, and possibly of other kinds of fish. He also states that he has selected a place in the neighborhood of Arendal for an establishment of this kind.

In regard to this matter I take the liberty to state that it appears from the official reports of Prof. Spencer F. Baird, United States Commissioner of Fish and Fisheries, that the artificial hatching of the roe of cod, and some other salt-water fish, is not only possible, but also entirely practicable, without any very great outlay. How far the artificial hatching of salt-water fish produces a noticeable increase of the quantity of fish in the sea, and especially what it amounts to as compared to the vast scale on which the natural reproduction of fish goes on in the sea, has not yet been shown by experience, and may, therefore, justly be considered a disputed question. If, however, we consider the enormous destruction of roe caused by the many injurious influences to which it is exposed in the sea, and that these injurious influences may almost be entirely removed from the artificially impregnated roe, and that, therefore, there can be no doubt that roe of a certain number by being artificially hatched will yield infinitely more young fish than if left to nature; then we may well assume that there is not only a possibility, but even a certain degree of probability, that practical results for the fisheries may be reached. It is provided, of course, that the matter is taken in hand energetically. We must call special attention to the circumstance that Norway, on account of the peculiar character of its coast and coast waters, offers greater chances for favorable results than almost any other country. Our coast, broken by innumerable fiords and sounds, possesses a very large number of comparatively sheltered basins, whose stock of fish, as experience seems to show, is stationary, as the fish do not, to any great extent, seem inclined to migrate to the open sea. We must also consider that the deep furrow or trough at the bottom which separates the greater portion of our coast from the outer and shallower sea is in all probability the main cause which deters the fish which are born near our coast from migrating to the open sea. These geographical conditions, therefore, seem to justify the belief that the increase in the number of fish which would result from artificial hatching would really benefit our country, and not be scattered over all the neighboring seas. And yet it can by no means be considered as settled that artificial hatching will to any noticeable degree increase the yield of our every-day sea-fisheries. This is certain, however, that vast interests are at stake, and that no means should be left untried which, without disproportionate sacrifices, may reasonably be supposed to aid this important industry. It would be difficult to point out any other means which could be employed for reaching the end in view with greater hope of success.

I therefore take the liberty to express my opinion to the effect that, in spite of all the uncertainty which still seems to be connected with artificial hatching as a means of aiding the sea fisheries, it is in the highest degree desirable that experiments in this direction should be made, and the sooner the better. But if good results are expected, these experiments should be made on a great scale. We should not rest satisfied to hatch a few hundred thousand fish, but many millions. On account of the great fecundity of salt-water fish, hatching on such a scale is by no means an impossibility.

CHRISTIANIA, *October* 31, 1882.

OPINION OF PROF. G. O. SARS.

After having conferred with Captain Dannevig relative to his plan of counteracting the steady decrease of fish noticed during the last few years in the neighborhood of Arendal and on other parts of our coast, by the artificial hatching of salt-water fish, especially cod, I shall, as requested, express my opinion as to the practicability and the possible results of such experiments. I have already, in the first report made to the department on the practical and scientific investigations made by me near the Loffoden Islands, during the winter of 1864, expressed the opinion that possibly the artificial hatching of cod roe might yield important practical results; and in the following report, for 1865, I have treated this subject more fully and have given various hints for the guidance of persons who might desire to make experiments in this direction. It is my opinion that this matter deserves our undivided attention, and that, under certain circumstances, the artificial hatching of salt-water fish will have the same practical importance for our coast fisheries as the hatching of fresh-water fish for the fresh-water fisheries. With a view to obtaining greater certainty as regards this matter it will be necessary that a first attempt should be made, and that this attempt should be on so large a scale as to give some reasonable hope of visible results. Hitherto no such attempt has been made in Norway, and probably for the reason that no one has been found willing to devote his entire energy, talents, and time to the subject. I therefore consider it exceedingly fortunate that a gentleman has come forward who has seriously determined to solve this important problem in a practical manner. Captain Dannevig, is a gentleman of intelligence, who combines a deep interest in the cause with great energy and a practical knowledge of everything pertaining to the fisheries, and who therefore offers all the requisite conditions for making the experiment in an entirely satisfactory manner, provided he can secure the necessary assistance and guidance. As regards the practicability of this experiment, I have—as will be seen from my reports referred to above—by experiments of my own, made on a small scale, proved beyond a doubt that the artificial hatching of cod roe is not only entirely practicable, but even connected with comparatively less difficulty than the

hatching of salmon roe. The apparatus can be arranged in a much simpler manner, and the time used for hatching is much shorter. As the matter is of great interest both from a scientific and practical point of view, and as the question relates to an enterprise which, if it meets the expectations, will exercise the most powerful influence on one of the most important industries of our country, I deem it entirely proper that the Government should extend some aid, so that Captain Dannevig's experiments can be made according to the most approved method.

According to my observations, the tender young of the cod in the beginning keep near the surface of the water, but after a while seek the bottom and during the first year stay near the coast. Later they go farther out into deep water, but nevertheless during the first two or three years keep principally in the fiords and sounds, partly on sandy and partly on rocky bottom. Not until they have become sexually mature (in the fifth or sixth year) do most of them go to the outer banks of the sea, to return in spring for the purpose of spawning.

CHRISTIANIA, *November* 1, 1882.

CIRCULAR INVITING CONTRIBUTIONS TOWARDS A HATCHING ESTABLISHMENT FOR SALT-WATER FISH ON THE AMERICAN PLAN.

It may be considered as sufficiently well known that during the last twenty or thirty years our coast fish have steadily decreased, and that during the last few years this decrease has even been more rapid than formerly; so much so, in fact, that many of our fiords where formerly large masses of fish were found are now comparatively deserted. It may also be considered as well known that the number of fish along the entire coast of Norway from Christiania to Cape Lindesnæs has likewise decreased to an alarming degree, especially in places where a dense population and the high price of fish make the fish more sought after. Such is the case in the neighborhood of Arendal.

The probable cause of this decrease is undoubtedly excessive fishing, which takes away more fish than nature can produce; and if this state of affairs continues for any length of time, the consequence will be, that some of our more important kinds of fish will become extinct.

The natural character of our coast justifies this supposition, for although the bottom is particularly adapted to maintain large masses of fish, in must be remembered that on our coast the fish are crowded together within a comparatively narrow space, viz, the narrow channel—hardly 1 Norwegian mile (7.01 English miles)—along the coast, and that therefore excessive fishing will exterminate the fish sooner on this coast than on the other coasts of the North Sea, where the coast waters are connected with the great fishing-banks in the open sea, and where the loss is soon made up again by fish immigrating from the sea.

If we ask which apparatus must be considered as particularly destructive, the proper answer will be that it is not one apparatus in particular, but all the different apparatus combined which have brought about this result.

As we must consider it as absolutely certain that excessive fishing is the cause of the decrease of fish, it will be evident that in order to remedy the evil it will be necessary either to limit fishing, so that the natural increase of fish exceeds in number those which are caught, or to endeavor by the artificial production of fish to raise the increase to such a degree that it shall at all times exceed the number of fish caught.

As regards the first-mentioned plan, it must, from various causes, be considered as impracticable; and no other way is left but the artificial production of fish, which can no longer be considered merely as a scientific experiment, but as an industry which, without involving great expense, can be conducted on a large scale. The artificial hatching of fish may be considered as the only means of raising our coast fisheries to their former flourishing condition, and as these fisheries are of the most vital importance to our coast population, we venture to hope that such an undertaking will meet with general interest. It is a question of preserving a large capital for the benefit of our coast population. In the city of Christiania alone, live fish to the amount of several hundred thousand crowns are sold every year; and if we take the entire coast from Frederikshald to Lindesnæs, the sum amounts to several millions of crowns per annum. To preserve this revenue to our country will not only prove a great advantage to the present generation, but it actually becomes a duty which we owe to posterity.

The Arendal division of the "Society for Promoting the Norwegian Fisheries" is fortunate enough to have among its members Capt. G. M. Dannevig, who takes a deep interest in the artificial hatching of salt-water fish as a means of aiding our coast fisheries. He has carefully studied the entire subject of starting a hatchery on the American plan, and has consulted some of the most prominent scientific authorities in our country, Professor G. O. Sars, Professor H. Rasch, and Mr. A. Landmark, inspector of fisheries, whose opinions regarding this matter are quoted.

A hatchery on the American plan will, according to very careful estimates, cost about 4,400 crowns ($1,179.20), and the current expenses during the first year of 3,000 crowns ($804) will make a total of 7,400 crowns ($1,983.20). It is our intention to start a hatchery as soon as we have secured the necessary funds.*

SOCIETY FOR PROMOTING THE NORWEGIAN FISHERIES,
Arendal Division, December 2, 1882.

* This circular is signed by L. Holmboe, Oscar Herlofson, Ole J. Herlofson, Andr. E. Johannesen.

32.—THE BOWER-BARFF RUSTLESS IRON.

By J. H. KIDDER, M. D.

[From letters to Prof. S. F. Baird.]

I return herewith the specimens of iron pipe treated by the "Bower-Barff rustless iron" process, with memorandum of the results of examination and the following note upon the process itself:

Dr. Percy first pointed out the fact that Russian sheet-iron is much less affected by rust than English, because it has been accidentally coated with magnetic oxide (Fe_3O_4).

Professor Barff, prior to the year 1876, first produced a coating of magnetic oxide upon iron *for the purpose* of preventing rust. He exposed the heated metal to superheated steam, which at high temperatures is decomposed, giving up its oxygen to the iron, while hydrogen escapes.

Mr. George Bower improved upon Barff's method (about the year 1880) by passing the products of imperfect combustion (carbonic oxide, &c.) through highly heated chambers containing air in slight excess of the quantity required to convert carbonic oxide into carbonic acid. The resulting carbonic acid, heated by combustion, enters a chamber containing the articles to be coated, raising them to a high temperature. The iron takes oxygen from carbonic acid and becomes magnetic oxide at its surface, covered by a film of sesquioxide, while carbonic oxide escapes. This process, called the "oxidizing process," is continued for half an hour, when the air inlet is closed and only carbonic oxide admitted to the iron. Carbonic oxide (CO) takes oxygen from the film of sesquioxide covering the magnetic oxide, reducing all of the coating to magnetic oxide. This is called the "deoxidizing process," and lasts twenty minutes. The two may be repeated according to the thickness of oxide desired.

There is no reasonable doubt that magnetic oxide of iron is unaffected by exposure to air or fresh or salt water, or that, if thoroughly and completely applied, a coating of this oxide will protect iron surfaces from rust. The specimens experimented upon appear not to have been thoroughly coated, especially in the screw-threads, and there is some reason for suspecting galvanic action upon the specimen A (in salt water). I believe that the authorities at the Portsmouth dock-yard have already decided that such action will occur when coated and uncoated specimens are exposed together to sea-water.

For further experiment in this direction I recommend that some strips of iron be furnished which have been completely covered with the magnetic oxide, exposing no unoxidized surfaces. The strips may conveniently be 3 inches wide by 4 inches long, but should not be sheared

(as in the specimens received last week) so as to expose unoxidized surfaces.

MEMORANDUM.

Two specimens of iron treated by Bower-Barff process; received December 5, 1884.

A. Short tube, with male screw-thread on each end, immersed December 6 in sea-water, in an open jar. The sea-water was from the surface of the sea, 40 miles off Cape Hatteras, and of specific gravity 1,026.1. The pipe showed no rust at the time of immersion. Removed from the water, which has been kept at about 70° F., January 13. The specimen is much rusted, particularly in the screw-threads. One side remains clean, and the corrosion is most decided on the side opposite—possibly because of galvanic action. The water is quite muddy from sesquioxide of iron, and presents a scanty iridescent pellicle containing Bacteria (mostly *B. termo*). No infusoria.

B. A bent coupling, with female screw in each end. Immersed December 6 in tap-water, jar tightly stopped; exposed, together with A, to sunlight and average temperature of 70° F. Removed from water January 13. Specimen has also rusted, but the rust is in this case confined to screw-threads and a file-mark on convex surface. No sign of life in the water.

SMITHSONIAN INSTITUTION,
Washington, D. C., January 13, 1885.

SECOND REPORT.

Since the date of a former report upon the Bower-Barff iron process (January 13, 1885) several new specimens have beeen received, consisting of (A) strips of iron three-fourths inch wide by one-fourth inch thick, and (B) cylindrical rods one-half inch in diameter, all coated with magnetic oxide by the Bower-Barff process. The ends of the specimens, which had been sheared in cutting them into short lengths, showed a little sesquioxide of iron, although supposed to have been treated after cutting.

There being a question as to the occurrence of galvanic action between this magnetic oxide and iron or other metals in presence of sea-water, several battery cells have been made and tested in the course of the last ten days. Each cell was made up of two of the protected strips or rods for one element, a similar surface (about 16 square inches) of unprotected iron for the other, and a sample of very clear sea-water, of specific gravity 1,027, taken in the Gulf Stream about 40 miles north east of Cape Hatteras. In the earlier experiments the sheared ends immersed were covered with red sealing-wax, and copper wire was used for electrodes. In cells after the first two the sheared ends were covered with bees-wax and platinum wire substituted for copper. In each experiment the circuit was allowed to remain closed for from two to five days.

The galvanometer showed a decided current in all of the experiments, the pole attached to the protected plate being positive. Magnetic oxide is therefore electro-negative to unprotected iron, as was to have been inferred from the known electric relations of the protoxide and sesquioxide of which it has been supposed to be made up. The current is scarcely, if at all, stronger when two cells are connected in series than in each of them examined singly. The unprotected iron (electro-positive) element wastes away, remaining clean excepting for a thin, greenish, semi-gelatinous film (hydrated ferrous carbonate), while the cell fluid becomes turbid within twelve hours from the accumulation of sesquioxide of iron. In three out of four cells small masses of sesquioxide adhered to the surface of the protected (electro-negative) element, and were found to mark spots of disintegration and removal of magnetic oxide. In one cell the protected surface remains unaffected after seventy-two hours of closed circuit, the fluid being densely turbid by the accumulation of sesquioxide.

When diluted hydrochloric acid (about 4 per cent. strength) is used as an exciting fluid, the action is much more vigorous and both plates are attacked, the unprotected more actively than the protected. When copper is substituted in a sea-water cell for unprotected iron, the direction of the current is reversed, copper being electro-negative to magnetic oxide, and the magnetic oxide is rapidly decomposed, with the production of sesquioxide. Iron is found (after fourteen hours) deposited upon the copper surface and in solution in the filtered cell fluid. No copper is to be found upon the iron surface or in solution.

It appears from these experiments that there *is* galvanic action between unprotected wrought-iron and the magnetic oxide of iron in presence of sea-water, at the expense of the unprotected iron. The action differs only in degree from the ordinary rusting of iron, which has been well described as a galvanic process from the moment that a particle of sesquioxide has been formed. The beginning of rust is generally determined by the presence of carbonic acid, which produces hydrated ferrous carbonate, and is in turn displaced by oxygen in solution in the water. From the moment of the appearance of sesquioxide of iron, a compound which is electro-negative to iron, galvanic action begins, and determines a further supply of oxygen by electrolysis of the water. So in the cells here referred to hydrated ferrous carbonate is found upon the positive surface, and sesquioxide of iron free in the liquid or adhering to the negative surface. Internal currents result from the interaction between iron, its carbonate, and its oxides, and diminish the resultant current strength as measured by the galvanometer.

The experiments still indicate that the covering of magnetic oxide is not thick enough or not complete, since most of the specimens have broken down more or less in sea-water. If thoroughly coated there seems to be no reason to fear damage to protected iron near unprotected iron in sea-water, the tendency of galvanic action in that case being

altogether against the unprotected iron, which is electro-positive to magnetic oxide.

It appears, however, that the neighborhood of copper or its compounds in sea-water would probably be destructive to a surface of magnetic oxide, as was the case in the experiment noted. Whatever galvanic action occurs in such a couple must necessarily be at the expense of the magnetic oxide. The presence of zinc, tin, or lead would probably be protective to the iron.

In conclusion I may say that this examination indicates that the magnetic oxide is an effective protection against the ordinary processes of iron rust; that the kind of galvanic action which occurs between iron and its magnetic oxide in presence of sea-water is altogether at the expense of the former; that the neighborhood of copper, nickel, silver, or other metal electro-negative to the magnetic oxide of iron in presence of sea-water will lead to the speedy destruction of the magnetic oxide; and, finally, that the specimens thus far examined appear to have been exposed to the protective process for too short a time to insure full security under the conditions presented by the requirements of the Fish Commission.

SMITHSONIAN INSTITUTION,
Washington, D. C., February 23, 1885.

33.—REPORT OF OPERATIONS AT THE HATCHING ESTABLISHMENT FOR MARINE FISHES, ARENDAL, 1884.*

By G. M. DANNEVIG.

To the Management of the Arendal and Omegn branch of the Society for the Promotion of the Norwegian fisheries:

I have the honor to submit to the board of managers the following report of the operations of the hatching establishment during the year 1884:

COD.—On account of the easily foreseen difficulties in procuring the necessary number of parent fish, the purchase of these was commenced at the beginning of the year and continued without interruption until about the middle of the month of April. The fish obtained were, however, very small, and yielded in consequence little spawn, which will, to some extent, explain the comparatively small result which the establishment has to show for the present year. It will be evident also, from the detailed report given below, that there were other causes which operated strongly in the same direction. Besides, we should not leave out of consideration the fact that, as director of the establishment, I had to confront an entirely new experiment, and that, in addition to theoretical knowledge, there is required also a practical acquaintance

**Beretning over Virksomheden ved Udklækningsanstalten for Saltvandsfisk.* Arendal, 1884. Translated from the Norwegian by TARLETON H. BEAN.

with the subject, which can be acquired only after considerable experience. The actual hatching operations begun on February 19th and continued until April 29th, when the last fry were liberated.

Table showing the extent of cod-hatching from February 19 to April 27, 1884.

Date.	Number of eggs fertilized.	Total number of fertilized eggs.	Eggs rejected.	Net stock in the apparatus.	Fry liberated.	Water at 8 a. m.		Remarks.
						Specific gravity.	Temperature Fahr.	
Feb. 19	525,000	525,000	.....	525,000	.....	.....	.....	
22	60,000	585,000	200,000	385,000	.....	.....	.....	
25	450,000	1,035,000	.....	835,000	.....	.....	.....	
26	75,000	1,110,000	75,000	835,000	.....	.....	.....	No eggs were rejected from February 26 to March 7, because all of them were so fouled by impure water that it was impossible to separate them.
27	300,000	1,410,000	.....	1,135,000	.....	.....	.....	
28	800,000	2,210,000	.....	1,935,000	.....	.....	.....	
29	150,000	2,360,000	.....	2,085,000	.....	.....	.....	
March 1	300,000	2,660,000	.....	2,385,000	.....	.....	.....	
3	250,000	2,910,000	.....	2,635,000	.....	.....	.....	
4	150,000	3,060,000	.....	2,785,000	.....	1.020	.....	
6	350,000	3,410,000	.....	3,135,000	.....	1.022	.....	
7	175,000	3,585,000	500,000	2,810,000	.....	1.024	.....	
8	125,000	3,710,000	.....	2,935,000	.....	1.022	.....	
12	625,000	4,335,000	.....	3,560,000	.....	1.019	36.50	
14	100,000	4,435,000	.....	3,665,000	.....	1.019	36.95	
17	480,000	4,915,000	275,000	3,815,000	50,000	1.018	37.62	
18	.....	4,915,000	400,000	3,410,000	5,000	1.018	36.05	
20	250,000	5,165,000	800,000	2,860,000	.....	1.024	38.75	
21	.....	5,165,000	1,100,000	1,760,000	.....	1.025	39.42	
22	40,000	5,205,000	.....	1,800,000	.....	1.024	38.75	
23	175,000	5,380,000	.....	1,915,000	60,000	1.022	38.75	
24	1,000,000	6,380,000	600,000	2,205,000	110,000	1.020	37.62	
25	500,000	6,880,000	150,000	2,555,000	.....	1.019	37.62	
26	375,000	7,255,000	100,000	2,830,000	.....	1.022	38.07	
27	500,000	7,755,000	200,000	3,090,000	40,000	1.021	37.85	
28	.....	7,755,000	125,000	2,915,000	50,000	1.024	38.97	
29	850,000	8,605,000	95,000	3,663,000	10,000	1.025	39.20	
30	150,000	8,755,000	.....	3,785,000	25,000	1.024	39.20	
31	500,000	9,255,000	575,000	3,615,000	95,000	1.025	39.87	
April 1	650,000	9,905,000	785,000	3,345,000	135,000	1.019	38.97	
2	450,000	10,355,000	.....	3,795,000	.....	1.023	38.97	
3	450,000	10,805,000	.....	4,245,000	.....	1.027	41.45	
4	750,000	11,555,000	.....	4,995,000	.....	1.027	41.00	
5	220,000	11,775,000	.....	5,215,000	.....	1.025	39.87	
6	.....	11,775,000	.....	5,215,000	.....	1.020	39.20	
7	.....	11,775,000	.....	5,215,000	.....	1.021	39.65	
8	600,000	12,375,000	440,000	5,375,000	.....	1.020	40.55	
9	.....	12,375,000	300,000	4,995,000	80,000	1.020	41.00	
12	.....	12,375,000	530,000	4,425,000	40,000	1.020	40.32	
13	.....	12,375,000	.....	4,405,000	20,000	1.019	41.45	
14	.....	12,375,000	.....	4,385,000	20,000	1.020	41.00	
15	.....	12,375,000	.....	4,375,000	10,000	1.025	40.55	
16	.....	12,375,000	.....	4,120,000	255,000	1.017	43.25	
17	.....	12,375,000	.....	3,700,000	420,000	1.018	42.12	Liberated at Horekilen.
19	.....	12,375,000	.....	2,700,000	1,000,000	1.025	41.67	
20	.....	12,375,000	230,000	2,450,000	20,000	1.020	41.00	
22	.....	12,375,000	.....	1,990,000	460,000	1.020	42.35	
23	.....	12,375,000	.....	1,490,000	500,000	1.021	41.67	Liberated at Langevig.
24	200,000	12,575,000	.....	1,290,000	400,000	1.021	41.45	
25	.....	12,575,000	.....	1,040,000	250,000	1.024	41.45	
26	.....	12,575,000	.....	440,000	600,000	1.023	41.67	
27	.....	12,575,000	.....	.....	440,000	.....	.....	Eggs and young.
	.....	*12,575,000	7,480,000	.....	5,095,000	.....	.....	

* Maximum daily number of eggs.

From the above table it will be seen that upwards of 12,500,000 cod eggs were fertilized, and that 5,000,000 young fish, or 40½ per cent., were obtained from these. It will be observed also that the largest stock of eggs possessed at one time was somewhat over 5,000,000, which was merely one-eighth of the capacity of the establishment. Since it is not difficult, with an abundant supply of parent fish, to hatch out two broods in a year, the yield might be increased to about 80,000,000.

When I heard the American fish-culturists, at the London Fisheries Exposition last year, lament about the muddy water which they had to use, I stated somewhat freely that the sea-water on the Norwegian coast would be sufficiently clean for hatching purposes without filtering, and, as a result of my opinion, I had it pumped directly into a reservoir, from which it was afterwards conducted through wooden pipes and rubber tubes to the apparatus. It was quickly apparent that this was a great mistake, and that even very carefully constructed filters are necessary for successful hatching. It is unquestionable that the sea-water here is tolerably clear, but if we consider the fact that about 15,000 liters of water daily flow through each apparatus, and that the bottom of the box is covered with wire gauze so fine that neither eggs nor young fish can escape through it, we must realize that this gauze will arrest all the dirt contained in the water and soon become so clogged that the circulation will be greatly retarded. Moreover, if some of the eggs, which float freely in the box during the process of development, should from time to time come into contact with the bottom, these also will soon be coated with mud and will sink to the bottom and be destroyed usually within a few hours. The loss occasioned in this way was at first considerable, but after the water became cleaner through the use of filtering-frames, and I, besides, had learned by experience how to handle the eggs more carefully, there was an improvement, and, towards the last as high as 50 per cent. of young fish were obtained. This may indeed be regarded as very gratifying, especially when we consider the fact that the Americans, who had all possible expedients at their command, after a whole winter's work obtained a considerably smaller average.

The next difficulty which presented itself, and which caused a considerable loss of eggs, was the circumstance that the sea-water sometimes contained so little salt that its specific gravity was less than that of the eggs, which may be placed, with little variation, at 1.023. In consequence of this the eggs fell to the bottom, and were securely held there by the current, which has a downward movement as well as a rotary motion. It was possible, of course, to increase the saltness of the water, but not without considerable expense, and to move the whole establishment farther out to sea, to obtain salter water, was naturally not to be thought of, at least until other means had been tried to get rid, if possible, more easily of this drawback, which for a long time remained so serious that I even began to doubt the result. Naturally

there was nothing to be done but to direct all my attention to the apparatus, with a view of improving it if possible.

I must state here that the Americans, in their attempt to develop cod eggs in 1879, used many of the older forms of apparatus, but first obtained satisfactory results after the construction of an entirely new appliance. This, which was called from its inventor the Chester rotating apparatus, was, however, also encumbered with various drawbacks, and I determined, therefore, to experiment not only with the last named but also with one of the older forms, and I selected the so-called Clark's, which appeared to me to be the most successful. The experiments with this were, to be sure, unsuccessful in America, but when I based my calculation upon cleaner water I believed that it would prove effective in our country. The result showed that so far I was right; but now the fatal circumstance interfered—the salinity of the water at certain times was too low—and a new difficulty also intervened, which was not, and, without somewhat extensive preliminary experiments, could not have been foreseen. The difficulty was that the cod eggs, which are naturally developed at the surface, remained lying on the bottom, and that in an apparatus in which there is a descending current.

By accident I made the discovery that the greater or lesser inclination of the apparatus had considerable influence on the direction of the current, and after having made some experiments I had the Clark's apparatus set up in such a way as to secure a fall of 8 inches in 8 feet, instead of 1 inch in the same distance, as proposed by an American fish-culturist, Mr. R. E. Earll. By way of explanation allow me to give a short description of the structure of this apparatus. It consists simply of a water-tight box, 8 feet long, 2 feet wide, and 1 foot deep. It is divided lengthwise into two equal parts, and each of these again into five smaller compartments, by means of partitions.

As a result the box contains ten compartments of equal size, besides a smaller one in each end, which serve for the inflow and exit of the water. In each partition there is a depression containing a tin spout, through which the water flows from one compartment to another. Now, when the water is brought into the uppermost compartment this will be filled to within about one inch from the top, whereupon it will flow into the next division, and so on until all the compartments are filled. From the last an exit-pipe extends through the floor. In each of the ten compartments there is a wooden box, furnished with a wire-gauze bottom, and somewhat smaller than the space wherein it is contained. This wooden box has one of its edges pressed under the tin spout through which the water comes, and then it is naturally elevated at the opposite side in such a way that it rests somewhat obliquely.

In these small boxes, then, the eggs are placed, and, since the fine openings in the bottom furnish the only escape for the water, it is clear that the principal current must be descending. Now, by giving the box a greater inclination, as directed above, the water obtains, in leaving

the tin spout to enter the next compartment, a vertical fall of about three-fourths of an inch. The downward movement which the water hereby acquires changes its course so that, instead of flowing right off along the surface as before, it now proceeds towards the bottom, thence along the upward-inclined surface of the box, and then farther upward—in brief, it receives a whirling movement in a vertical, instead of, as heretofore, a horizontal direction. The eggs cannot now longer remain on the bottom, but must go with the current and be kept thereby in continual motion. The number of eggs injured in this way was very large; however, the loss was not total, since they could, to some extent, collect in the "eddies" of the hatching-box opposite the tin spout, also along the sides of the box, which is movable. In order to secure motion in the mass of eggs there is needed merely a brief pressure on the edge of the box, which pressure also forces the water up through the bottom, and I have determined to utilize this circumstance. Consequently I have had constructed an appliance which, by communication with a steam-engine, will furnish a uniform upward and downward movement to the egg-boxes. This apparatus, however, was finished too late to be tested during the more unfavorable condition of a too low salinity of the water.

It is essential, however, in this case, as well as under the former condition, to keep the apparatus absolutely clean, and to remove the dead eggs immediately. When there is a stock of 40,000,000 to 50,000,000 eggs in the establishment this will involve considerable labor, of course; but, on the other hand, there is reason to believe that careful filtering of the water before introducing it into the boxes will diminish the labor to a considerable extent.

FLOUNDERS.—As gravid flounders, chiefly *Skrubbe*,* were rather easily procured, and the greater portion of the apparatus stood idle for want of eggs, I resolved to make an experiment with these fishes also, and so much the more because no attempt of this kind had previously been made. The following table furnishes a synopsis of the results accomplished in this direction:

Table showing the extent of flounder-hatching from March 6 to April 28, 1884.

Date.	Eggs fertilized.	Total number of fertilized eggs.	Rejected eggs.	Net stock of fertilized eggs.	Young liberated.	Remarks.
March 6	100,000	100,000	.....	100,000	.....	
11	300,000	400,000	.....	400,000	.....	
19	750,000	1,150 000	150,000	1,000,000	.....	
24	.....	1,150,000	.....	955,000	45,000	
25	600,000	1,750,000	.....	1,555,000	.....	
26	200,000	1,950,000	.....	1,705,000	50.000	
27	200,000	2,150,000	.....	1,905,000	.....	
29	250,000	2,400,000	.....	2,010,000	145,000	
31	400,000	2,800,000	300,000	2,110,000	.....	
April 1	.....	2,800,000	400,000	1,710,000	.....	
4	.....	2,800,000	.....	1,560,000	150,000	
5	.....	2,800,000	.....	1,360,000	200,000	
7	500,000	3,300,000	.....	1,860,000	.....	

**Pleuronectes flesus.*

Table showing the extent of flounder-hatching from March 6 to April 28, 1884—Continued.

Date.	Eggs fertilized.	Total number of fertilized eggs.	Rejected eggs.	Net stock of fertilized eggs.	Young liberated.	Remarks.
April 8	350,000	3,650,000	.....	2,210,000	.....	
9	.....	3,650,000	300,000	1,660,000	250,000	
14	.....	3,650,000	.....	1,655,000	5,000	
16	.....	3,650,000	250,000	1,195,000	210,000	
17	.....	3,650,000	.....	995,000	200,000	
19	.....	3,650,000	300,000	595,000	100,000	
21	.....	3,650,000	.....	495,000	100,000	
22	.....	3,650,000	300,000	.....	195,000	
23	200,000	3,850,000	.....	200,000	.....	
28	.....	3,850,000	.....	.....	200,000	Fertilized eggs.
	.....	3,850,000	2,000,000	.....	1,850,000	

From 3,850,000 eggs were obtained 1,850,000 young fish, or 48 per cent., which was a somewhat better result than that secured with the cod. Flounder eggs are a little heavier than those of the cod, their specific gravity reaching 1.026, and we might suppose that they were more difficult to manage, especially when the water was too brackish. This, however, did not prove to be true, as they are more hardy than cod eggs and are not so easily destroyed by resting for a while on the bottom. An experiment with *Slette** and *Tungeflyndre*† conducted at the same time was equally successful. The period of incubation was from twelve to seventeen days, according to the temperature of the water. There are about 2,400 *Skrubbe* eggs in a gram, but the number varies considerably with the size of the parent fish.

LOBSTERS.—With a view of testing the possibility of developing lobster spawn after it was shed, I procured, on the 21st of June, some lobsters, which were kept in a box in the hatching-house after a portion of their eggs had been deposited.

The eggs, however, were placed in a specially constructed apparatus, which received a uniform water supply from the large reservoir of the establishment, which was pumped full every morning and evening, and during warm weather at noon also. After a space of about fourteen days the shells began to burst, and the young then appeared, surrounded only by the thin internal covering, which is not shed until they are able to swim, or after the first shedding of the skin. Beyond this stage, however, I was unable to rear a single young lobster out of the whole mass of eggs; they all died, without exception, within four days after they had escaped from the external shell, and before they were capable of swimming.

I had observed, though, that the temperature of the water exercised great influence on the longevity of the lobsters, and that this was increased proportionally as the water became cooler, whereas during very warm days they usually died within twenty-four hours.

After I had placed a new lot of eggs in the apparatus, on the 1st of August, I attempted to reduce the temperature by the use of ice; but

* *Pleuronectes limanda.* † *Pleuronectes solea, fide* Molbeck.—T. H. B.

as this was unsuccessful, on account of the warm weather and the heat radiated from the boiler, I had the pumping continued, with short intervals, from 6 a. m. to 10 p. m., and during the last week through the night also. In this way the water in the reservoir, as well as in the apparatus, was kept cooler, because it was not exposed so long to the warm air.

Now there was an improvement. On the 7th of August the first fully hatched young lobsters made their appearance in the boxes, and from that time until August 21, when the work ceased, some hatched out, as a rule, every day. The young were lively and disported themselves freely in the water, but seldom lived longer than a few days. I do not know what was the cause of this, but I believe it was want of food, since the water was filtered before it was introduced into the apparatus.

FLÖDEVIG HATCHING ESTABLISHMENT,
September 4, 1884.

POSTSCRIPT.—After my report of operations of the hatching establishment during the present year was delivered, I had an opportunity of informing myself more fully about a circumstance which is intimately connected with the same, and which I cannot omit to mention, since it furnishes rather satisfactory proof that the results of hatching are already beginning to appear.

On the 9th of September the fishermen living here set a so-called mat-net (fine-meshed net) to catch young herring for bait. When this was hauled I examined the catch, to discover if possible young cod of the year, and found therein, to my great delight, a score of these fish, measuring 2½ to 4 inches in length. Afterwards I examined the bottom alongshore with a water telescope, and saw plenty of young cod of the above-named size, a phenomenon which I had not observed before, although I have lived in the place eighteen years. In order to increase my knowledge of the matter, I inquired of the fishermen to what extent they had previously observed young cod in the catch of the mat-nets, but obtained the uniform answer that this was the first occurrence of the kind to their knowledge. A very old fisherman stated, however, that he had often seen such young cod "in the olden days," which is not surprising, because the number of cod along the coast at that time was considerable.

The young flounders, which were seen in large numbers previously during the summer, have within the last four to six weeks entirely disappeared. Probably they now frequent the bottom in sand areas, where it is difficult to discover them. I shall, however, direct attention to them also after the autumn, in order to obtain, if possible, more definite information concerning their development and their habits during the first year of their existence.

FLÖDEVIG, *September* 15, 1884.

Vol. V, No. 11. Washington, D. C. April 25, 1885.

34.—HOW LONG WILL OYSTERS LIVE OUT OF WATER?

By Prof. A. E. VERRILL.

My attention was recently called by Capt. C. H. Townsend to a large cluster of oysters attached to an old boot which had been hanging in the front windows of the fish market of Charles Reed, in this city, for a long time. This cluster was taken from the water in the early part of December, 1884 (about the 10th, it is said), and when I examined it on February 25 several of the larger oysters were still alive. I am told that they continued to live for some days afterwards. The larger ones which were still alive were of about the size ordinarily sold in the market. Most of the smaller ones were dead, and many of the larger ones, of which the edges had been broken or chipped, were dead and dried up when I saw them. Those that were alive had all been hung up with the *front edge of the shell downward* and the hinge upward. They had been hanging in the show window, attached to a gas-burner, during the whole time (over ten weeks), freely exposed to the air and light. The room was, of course, rather cool, as such shops usually are in winter, and the window space, although open freely to the shop, was doubtless still cooler, especially at night, but the air must have been dry and the temperature quite variable. The window faces to the west and would have direct sunlight in the afternoon. The remarkable duration of the life of these oysters is undoubtedly due to two causes:

1. The perfect condition of the edges of the shells, which allowed them to close up very tightly.

2. The position, suspended as they were, with the front edge downward, is the most favorable position possible for the retention of water within the gill-cavity, for in this position the edges of the mantle would closely pack against the inner edges of the shell, effectually closing any small leaks, and the retained water would also be in the most favorable position to moisten the gills, even after part had evaporated. It is also possible that when in this position the oyster instinctively keeps the shell tightly closed, to prevent the loss of water.

This incident may give a hint as to the best mode of transporting oysters and clams long distances. Perfect shells should be selected, and they should be packed with the front edge *downward*, and kept moderately cool, in a crate or some such receptacle which will allow a free circulation of air. Under such favorable conditions selected oysters can doubtless be kept from eight to twelve weeks out of water. Probably the quahaug, or round clam, which has a very tightly closing shell, when perfect, can be kept equally long in the same way.

NEW HAVEN, CONN., *March* 9, 1885.

NOTE BY JOHN A. RYDER.

The observations of Professor Verrill are interesting and important. I have had oysters live in the shell for two weeks where the temperature ranged from 35° to 40° F. at night to over 80° F. in the day, lying on shelves in the cases in my work-room, exposed the whole time to the air, without showing the slightest tendency to decompose, every specimen containing and holding liquid in its mantle cavity. The position of the shells I did not notice. This was about two years since, and the facts did not then seem to me to have any practical bearing, as they now appear to, as suggested by Professor Verrill.

A striking observation which I made at that time, and which I recorded, I believe, in the sketch of the life history of the oyster prepared under my direction for the annual report of the Geological Survey, was the following: The specimen which served me as my "model" from which to sketch the external anatomy of the soft parts, published in that report and also in the Fishery Report of the Census, laid open for twenty-four hours, with one valve removed and the soft parts exposed to the air for the whole time, and yet at the end of that time, when the ventricle was touched, it began to slowly pulsate, and did so under this stimulus a number of times. This instance of tenacity of life on the part of a mutilated bivalve is pretty hard to excel for incredibility; in fact, had I not witnessed the facts as stated above, I would have been disinclined to accept them as a statement of the truth.

WASHINGTON, D. C., *March* 13, 1885.

35.—NEW ENGLAND FISHERIES FROM JANUARY 1 TO MARCH 31, 1885.

By W. A. WILCOX.

The winter fishing by the New England fleets is confined to the George's Bank cod, haddock, and halibut fleets, the frozen-herring catch of Grand Manan, Bay of Fundy, and Fortune Bay, Newfoundland. With the exception of vessels engaged in supplying the large fresh-fish markets of Boston and New York, and a few sail from the Provinces, the winter fishing is confined to vessels from Gloucester. A large part of the catch sold at the leading fresh-fish markets is also made by vessels from that port. The catch of codfish and mackerel during 1884 having been exceptionally large and prices lower than for years, not much encouragement was felt to engage in the dangerous winter fishing. The report for January shows few sail and light receipts.

SHORE COD-FISHERY.—Thirty-two sail from Gloucester have followed the near-home shore fishery for ground fish, the catch being made in Ipswich Bay and landed at Portsmouth, Rockport, and Gloucester. During the past winter, up to the middle of March, the entire catch was

made by gill-nets; after that date nets and trawls were both used. The history of the introduction of the gill-nets by the United States Fish Commission has been published, and it only remains to add that yearly they seem to grow in favor, and well they may, the catch by them being larger and better fish than by trawls when used side by side, and the saving of thousands of dollars for bait. It would be an interesting item to know just how much has been saved in the purchase of bait since the first use of gill-nets. We must be content by saying it is a large sum.

The catch of the past winter shows a gain over that of the previous year. During March the amount landed at this port by 32 sail was 101,000 pounds of cod caught in gill-nets and 116,000 pounds of cod caught by trawlers. Vessels averaged 6,000 pounds to a trip.

The amount landed at Portsmouth and Rockport during March, all made by gill-nets, was as follows:

For the week ending—	Pounds.
March 7	84,000
March 14	245 000
March 21	230 000
March 28	82,000
Total	641,000

MACKEREL-FISHERY OF 1885.—Of late years, each spring the mackerel fleet starts south for the spring catch at an earlier date than the previous year. This year the first vessel to sail, the Mollie Adams, left Gloucester March 4; others soon followed. April 1 finds 83 sail on the ground from that port, and, including all other ports, 125 sail.

The first to arrive with fish were schooners Nellie N. Rowe and Emma Brown. They arrived at New York March 30, with 200 and 125 barrels of fresh mackerel of mixed sizes, mostly small, caught on March 26 and 27, 30 miles south of Cape Henry. Numerous other vessels arrived the following week, mostly with small fares of from 50 to 150 barrels each of fresh mackerel, of small size and inferior quality.

The first fresh mackerel landed at New York in 1884 was on March 24, and in 1883 on March 31.

As the season advances, the fleet will be increased to its usual size; a number of new vessels being added, and by those at present engaged in other branches of the fisheries.

FROZEN HERRING.—This branch of the fishery business is of value as furnishing a cheap food to the masses, as well as supplying the winter fleets engaged in the cod, haddock, and halibut fisheries with the best of fresh bait. Bulletin Volume 4 of the United States Fish Commission dates the first venture of a frozen-herring trip as the winter of 1853. Since that time it has grown to large size and importance; each year finds more vessels engaged and receipts proportionately larger.

The Bay of Fundy and Fortune Bay, Newfoundland, are the great centers of the catch, which is made by the native fishermen living in

the vicinity, and by them sold to the vessels, mostly from Gloucester, that visit the fishing sections for cargoes.

FORTUNE BAY, NEWFOUNDLAND.—During the past winter all the vessels from the United States that engaged in the Newfoundland herring-fishery belonged to the port of Gloucester, the first to sail leaving that port November 24; the fleet numbered 22 sail. One vessel went ashore and returned in ballast. Three cargoes arrived at Gloucester and one at New York in vessels owned in Nova Scotia, making 26 sail engaged in the business. One vessel made two trips, all others only one, making 25 cargoes that reported at Gloucester and one at New York direct.

The first to return arrived at Gloucester January 3; the last cargo arrived March 16.

Herring were reported fully as plenty as in past years, but having struck in earlier than usual, they were the most abundant before the arrival of the fleet to buy them. Most of the fleet secured full cargoes, a few of them only partial fares. All were bought of the native fishermen, vessels from the United States not trying to catch any. Total amount reported arriving at Gloucester, 25 cargoes by 24 sail, aggregating 8,995,000 fish. The cargo direct to New York had 420,000 fish, and comprises the total receipts from Fortune Bay.

Of the vessels reporting at Gloucester, 16 sail disposed of their cargoes at Boston, New York, and Philadelphia.

BAY OF FUNDY.—Twenty-four vessels from Gloucester and 10 from Maine reported at the former port with cargoes of frozen herring purchased at Grand Manan and vicinity. These 34 sail landed 42 cargoes, aggregating 10,888,000 fish. Quite an amount also arrived at Boston by rail and steamer. One vessel from that port also landed a cargo, but the bulk of the business is covered by the amount mentioned.

This large amount of frozen fresh fish was taken by the fresh-fish trade, and by them distributed all over the country, as well as supplying the market-boats and fleets engaged in the winter fisheries with fresh bait. During the season herring were found in average abundance.

GEORGE'S BANK FISHERIES.—The large fresh-fish markets look to this bank for most of their winter supply of cod, haddock, and halibut. The reputation for George's boneless or prepared salt codfish is well known as the best, always commanding extra prices over all other salt codfish, and calling for a large amount.

The general depression in trade and much lower prices than usual account for a much smaller fleet during January than usual. Only 22 vessels from Gloucester were engaged during that month; in February, 60 sail; and March found the fleet increased to 103 sail.

During February cod and haddock were very plenty, halibut an average catch. During March the catch of cod fell off nearly one-half,

and halibut seemed to have almost entirely disappeared, very few being caught.

NEW VESSELS AND PROSPECTS.—The record of the past year may be given as anything but favorable or encouraging for the future. It may appear strange and certainly unfortunate that a year of unusual abundance and large productions should financially be one of very little, if any, profit, and in many cases of losses. This is accounted for from many causes—a general depression in trade and consequent shrinkage in values, large productions of the leading fisheries, inferior size and quality of the mackerel catch, and the importation of foreign fish free of duty. With all of these drawbacks and discouragements, a ray of light is seen in the near termination of the Washington treaty and hopes of some protection in the future, as well as of better prices and quality in the catch of 1885.

The number of vessels fishing on the Grand Banks will be less than last year; the near-home and mackerel fleets will probably be somewhat larger.

Quite an addition of new vessels will be added to the fleet. Essex, Mass., has launched four, and now has ten more on the stocks that will soon be engaged in the fisheries. Other eastern ports will also furnish a number of new vessels for the fisheries.

The number of vessels from Gloucester engaged in the fisheries March 31, 1885, is as follows:

	Sail.
George's Bank, cod and halibut	103
Shore, cod	32
Bank, cod and halibut	47
Bank, halibut	30
Mackerel	83
Total	295

All of the above are actively engaged, the bank fleet fishing on the Grand and Western Banks.

April will find large additions to the above and the full fleets in operation, courageously looking forward for better times and a more prosperous season.

TABLE I.—*Fish receipts at Gloucester during January, February, and March.*

Year.	Codfish.	Halibut.	Number of frozen herring.
	Pounds.	*Pounds.*	
1885	5, 684, 900	1, 180, 700	19, 888, 000
1884	5, 630, 900	1, 209, 100	14, 730, 000
1883	4, 318, 000	1, 207, 893	16, 549, 000
1882	5, 229, 000	1, 626, 100	18, 084, 000
1881	7, 381, 000	2, 377, 900	11, 520, 000
1880	7, 654, 000	1, 881, 000	8, 500, 000
1879	4, 254, 000	3, 286, 000	6, 290, 000

TABLE II.—*Receipts of frozen herring at Gloucester.*

Date.	From Grand Manan.		From Fortune Bay, Newfoundland.	
	Cargoes.	Number of fish.	Cargoes.	Number of fish.
1885.				
January	5	1,100,000	2	775,000
February	19	5,183,000	15	5,960,000
March	18	4,605,000	8	2,260,000
Total	42	10,888,000	25	8,995,000

Total from Grand Manan and Newfoundland, 67 cargoes, with 19,883,000 herring.

The number of vessels engaged from Newfoundland was 25 sail; from Grand Manan, 32 sail; total, 57 sail.

One vessel made two trips to Fortune Bay; 1 returned in ballast, all others with one cargo each; 23 made one trip, 8 two trips, and 1 three trips to Grand Manan.

TABLE III.—*Receipts of ground fish at Gloucester, Mass.*

Date.	Fares.	From—	Codfish.	Halibut.	Haddock.
1885.			*Pounds.*	*Pounds.*	*Pounds.*
January	11	George's Banks	270,000	18,500	
	1	La Have Banks	35,000	5,000	
	5	Shore, Ipswich Bay	20,000		
	6	The Banks		153,000	
	23		325,000	176,500	
February	47	George's Banks	1,017,000	97,900	132,000
	2	La Have Banks	50,000	14,000	
	15	Shore, Ipswich Bay	26,900		84,000
	13	The Banks		198,800	
	77		1,093,900	310,700	216,000
March	121	George's Banks	4,019,000	85,500	60,000
	36	Shore, Ipswich Bay	217,000		
	2	La Have Banks	25,000	24,000	
	20	Fishing Banks	5,000	584,000	
	179		4,266,000	693,500	60,000
Total	279		5,684,900	1,180,700	276,000

36.—NEW ENGLAND FISHERIES IN APRIL, 1885.

By W. A. WILCOX.

April is usually one of the dullest months in the year with the fish trade, and also one of the busiest with the producer, the past month proving no exception.

The demand for all kinds of fish has been very light and prices unprecedentedly low. The producers have been busy in preparing for the season's work, large additions have been made to the fleets, and the close of the month finds the larger part of the vessels actively engaged or nearly ready to sail. The Grand Banks cod fleet is leaving later than usual; will not number as many sail; most of them will make only

one trip. The mackerel fleet now numbers 184 vessels, of which 102 are from Gloucester; during the next two months it will be largely increased. The fleet has worked north slowly, the result being very unsatisfactory.

MACKEREL.—From the taking of the first mackerel, on March 26, to the latter part of April, the catch was confined to a few vessels, the fish of medium and small size, quality poor, and marketed fresh at low prices. On April 23 and 24, in longitude 74° to 75°, latitude 37° to 38°, the fleet found mackerel in great abundance, and over 100 sail secured fares. On April 25, 26, and 27, 93 sail arrived at New York and 14 at Philadelphia, with from 100 to 300 barrels each, the aggregate amount landed at New York from Saturday to Monday noon being estimated at 11,000,000 fresh mackerel and 500 barrels of sea-packed. This is by far the largest amount of fresh mackerel on record as having been landed at any one port in so short a time. This immense amount, arriving at once, overstocked the market; prices quickly fell from $2 to $6 a hundred, to 50 cents to $2 a thousand fish; large quantities were given and thrown away. The salt mackerel, being of poor quality, sold at from $2.25 to $2.75 a barrel, in all cases the fishermen realizing very little from the catch.

The fish averaged 90 per cent. from 10 to 12 inches in length, the remainder from 12½ to 14 inches, and give promise of good fish later in the season, a decided improvement in size over that of last year. The mackerel were quite well filled with the fine red food called by the fishermen "cayenne."

The following from the Fishing Gazette, of New York, gives some interesting items connected with the great catch:

"A sight was witnessed in our market on Monday morning last that is without a parallel in the history of the fishing business. One hundred sail of mackerel vessels were in port, either unloading or waiting for an opportunity to do so. The slip at Fulton Market has a capacity for only forty sail, and the vessels of the fleet were obliged to seek wharfage wherever it could be obtained, and all along the East River docks, around Washington Market and the docks of the North River, at docks in Brooklyn, the vessels were unloading. A close estimate made from the actual catch of a number of vessels warrants the statement that there were from eight to ten millions of fish either in process of unloading or waiting to unload. The greater portion of these fish were caught about 120 miles southwest of Barnegat, and were supposed to have formed one immense school. So numerous were the fish that in several instances single hauls of the seine netted 250 barrels; the Mollie Adams, Captain Jacobs, brought in 400 barrels taken in four hauls. This enormous supply of course ran prices down to almost nothing, the fish being sold at from 50 cents to a dollar per thousand; it also affected the price of all kinds of fish, and the cry was 'Down, down.'

"The Elizabeth M. Smith, Captain Black, in making a haul for mack-

erel, got a large number of tunny fish (also called horse mackerel and albicores) into the seine. These fish tore the seine very badly, but they succeeded in taking about 500, of an average weight of 35 pounds each, and brought them into market and sold them at from 10 to 25 cents each. The Mollie Adams also brought in about 8 barrels of this fish. The tunny is not a popular fish; the flesh, however, resembles lean pork, with a fine mackerel taste, and the time will probably come when it will form a more important feature of marketable fish.

"The inevitable results of such an excessive oversupply of fish began to be manifested on Tuesday night and Wednesday morning. The fish began to spoil before they could be disposed of, and Inspector Hamilton was kept busy in condemning such as were unfit to sell. Over 300,000 were dumped on the pier, their ultimate destination being Barren Island, where they will be converted into fertilizers."

After disposing of this large amount of fish, the fleet, on going to sea, encountered a severe gale on April 29. Some twenty seine boats were lost. As yet only one vessel has reported loss of life. The schooner Neponset, of Boston, lost her seine boat and four men.

COD AND HALIBUT.—The George's Bank cod and halibut fleet have found fish abundant, landing good fares as compared with the corresponding month of last year. The catch of codfish was a little more than double; of halibut, three times the quantity.

SHORE FISHERIES.—The shore catch of codfish, almost entirely from Ipswich Bay, was taken by gill nets and trawls. The fish were mostly caught from 2 to 8 miles from the shore, between Newburyport and Portsmouth. The amount landed was as follows: At Gloucester, from gill nets, 144,000 pounds, and from trawls, 211,000 pounds; at Rockport and Portsmouth, from trawls, 175,000 pounds, and from gill-nets, 525,000 pounds.

With the exception of a few scattering sail, the Ipswich Bay codfishery closes from the last of April until late in the fall. A few sail from Provincetown have fished for cod and halibut on Nantucket Shoals. Ten miles southeast of the fishing rips they found halibut more plentiful than for many years; three sail landed at Gloucester 17,000 pounds. These fish were noticed as being exceptionally fine, large, and thick; would average something over 100 pounds each, some weighing near 300 pounds; were over two-thirds white.

THE BANK HALIBUT FLEET.—These vessels fished during January, February, and March on the southern edge of the Grand Banks. During the past month the catch was mostly made in what the fishermen call the "gulley," lying between Banquereau and Grand Banks, in 175 to 225 fathoms of water, landing 612,000 pounds, the catch on Grand Banks alone being 131,000 pounds. Vessels mostly arrived with good fares, which brought them fair prices.

WEIRS AND TRAPS.—The close of the month finds this branch of the business just getting under way. Provincetown Harbor, between that

port and North Truro, is lined with sixteen weirs put down the past month, $80,000 being invested. They are of value in supplying the fishing fleets with plenty of fresh bait.

THE OUTLOOK.—Prospects for the season now indicate another year of large production. Although the migratory fish have been late in arriving, they seem to have come in unusual abundance. The catch of alewives in the Susquehanna and Potomac has been the largest for years. Very little preparation is made for the cure of these fish caught in that section; in consequence the price dropped from the customary one of 25 to 50 cents a hundred fish to the same price per thousand; during the last week in April even lower prices were taken.

THE WHALE FISHERY.—Whale-fishing off the New England coast by small steamers is getting to be quite a business. During the past two months four steamers have been engaged in this work, viz, Fannie Sprague, Mabel Bird, Hurricane, and Josephine.

They cruise off the Maine and Massachusetts shores as far south as Cape Cod. A bomb-lance, fired from a gun held at the shoulder, is used for killing the whales. Up to date about 40 whales have been captured.

As the men become expert in the manner of capture, the whales become shy and keep more in deep water. After being killed they usually sink, and it is doubtful if the business, as at present conducted, will last if the whales are driven off from near shore, it being difficult to recover them in over 40 fathoms of water.

The whales captured the past few weeks average 60 feet long and weigh about 25 tons each; they yield about 20 barrels of oil, 2 barrels of meat, 5 tons of dry chum, and 2 tons of bone, about $400 being realized from each whale, on the average.

THE SEAL-FISHERY.—During the past month the steamers from provincial ports engaged in the seal-fishery have been returning home, having had one of the most successful seasons ever made in that business. Full returns will be given later.

The following from the Island Press is of interest:

"The seal-fishery has been unusually successful this year. Many steamers have returned from the sealing grounds loaded down almost to the water's edge. Steamer Ranger, with over 200 men on board, returned to St. John's with 35,600 prime young harp seals, the largest catch for her tonnage ever taken into any port in the world, every nook and corner of the ship being jammed full. She was compelled to steam slowly from the time of leaving the ice, to prevent upsetting, and had to creep home inch by inch. Fortunately the sea was calm all the way. Her deck, covered to the top of the rails with 7,100 seals, was a sight never before seen in St. John's. The companion-way was covered in, only room enough being left for a man to squeeze himself into the door-way. The lazaret contained 720, and 250 were stowed under the bunks in which the men slept. Eight puncheons were filled with oil, and the rest was stowed in the hold."

Receipts of fish at Gloucester, Mass., April, 1885.

From—	Fares.	Codfish.	Halibut.	Haddock.
		Pounds.	*Pounds.*	*Pounds.*
George's Bank	181	3,822,000	155,710	185,000
Western Bank	9	370,000	63,000	.....
Shore	38	355,000	17,000	.....
La Have Bank	2	45,000	.....	.....
Grand Banks	4	.....	131,000	.....
Fishing Banks	16	.....	612,000	.....
Total	250	4,592,000	978,710	185,000

Gloucester vessels fishing or en route to the fishing grounds April 30, 1885.

	Sail.
Mackerel fleet, south	102
Halibut fleet, Grand and Western Banks	36
Halibut and cod, Grand and Western Banks	49
Shore cod, Grand Banks	40
George's Bank, cod and halibut	115
Haddock fleet	20
Greenland halibut fleet	6
Iceland halibut fleet	5
Total	373

37.—NEW ENGLAND FISHERIES IN MAY, 1885.

By W. A. WILCOX.

The close of the month finds nearly all of the fishing vessels away on the various banks and fishing grounds, the total number reported being 943 sail and 7 steamers.

Mackerel have worked north slowly. The first of the month the fleet were taking them off the Delaware Breakwater, at the close off Block Island and No Man's Land, a few sail being off the Nova Scotia shore. On April 29 a severe gale caused the loss of 18 seine-boats, and the schooner Neponset, of Boston, lost 4 men. This was followed on the 14th of May by another heavy blow, in which 4 seine-boats were lost. During most of the month fish were found abundant. The larger part of the vessels brought their fish to market fresh; it caused an oversupply, and very little was realized for them. Prices ranged from 50 cents to $5 a thousand fish. The fish were mostly of medium size, about one-tenth being of large size. Those that were salted were also sold at very low prices; unculled, in fishermen's order, $2.25 to $3 a barrel. From a general depressed trade, an oversupply of fresh mackerel, inferior size and quality of salt mackerel, with severe losses by gales and rough weather, the mackerel catch this year, to date, has financially been a failure to nearly all engaged.

The first mackerel was taken in the weirs at Sandy Point, Cape Cod, on May 4. A large catch of fine fish is yearly expected at this point.

During the entire month the catch has been the smallest for years—only 30 to 40 barrels a day at the most, at the close of the month only 5 to 10 barrels daily.

May 18 the first mackerel was taken in traps at Gloucester Harbor, very few being taken during the month. May 18 the first mackerel were taken on the Nova Scotia shore, in traps, at Sanford, 6 miles from Yarmouth. May 22 the first taken in traps at Lunenburg, Nova Scotia. Drag-nets for mackerel will be used by 10 small vessels, averaging 15 nets to a vessel. The first set of the nets was made May 29, on Middle Bank, one vessel taking 600, one 700, mackerel of large size on the same day.

Codfish have been found plentiful on all the usual banks and fishing grounds. In Ipswich Bay both trawl and gill-net fishermen have done well. The latter took up their nets May 12, part of them going for mackerel, and others hand-line fishing on other grounds.

George's Bank furnished abundance of codfish the first part of the month, the catch falling off the latter part, being an average for the month. Only a small amount of halibut was taken.

Brown's Bank has yielded a heavy catch of codfish, with a few halibut. All the month the fish have been abundant, vessels making quick trips and full fares. Capt. Jeffrey Gerrior, of schooner Finance, one of the last arrivals, with a crew of 10 men, reports that he has made 7 trips to Brown's Bank between November 25 and May 30, landing 296,000 pounds of codfish. On his last trip fished in 35 fathoms, in latitude 42° 42′, longitude 65° 50′. He counted 52 sail fishing to the northeast and northwest of him, all within a radius of 3 miles. The fish were all taken over the side of the vessel by hand-lines.

Halibut receipts at Gloucester the first of the month were quite large, the price dropping as low as 2½ cents a pound. The larger part of the catch was made on Banquereau. Fish were found very plentiful off Burgeo, Newfoundland, only 4 miles from shore; but heavy bodies of ice prevented much fishing, destroyed the trawls, and sent the fishermen to the south. The latter part of the month the receipts fell off and prices were advanced.

Western Banks: Of late years, during May, the catch of cod and halibut on these banks shows a decrease, the past month being no exception, there being few vessels and in the aggregate light receipts from there during the month.

Pollock have been abundant off the south side of Cape Cod; 693,000 pounds were landed at Gloucester. They were all taken in purse-seines. In keeping with all other fish, they sold very low—50 cents a hundred for split fish.

Kingfish, from off Key West, are to a limited extent found in the fresh-fish markets of the large cities during the winter, and thought much of as a fresh fish. The U. S. Fish Commission steamer Albatross having brought a few back from her late trip south, they were for-

warded to Gloucester, to be smoked, as an experiment. Although the samples were caught during spawning time, and the fish in poor condition, they proved an excellent smoked fish, being tested by many experts, who pronounced them equal, and by some to be superior, to smoked halibut or salmon. As these fish are said to be very abundant, a new and valuable addition of food-fish may arise from the experiment in smoked kingfish.

The prospect continues favorable for a large catch of all kinds of fish during the season, as indicated in the report for April. The following extract from the Boston Globe of June 2 touches on the abundance of fish throughout the United States:

"PLENTY OF FISH.—The efforts of the Fish Commissioners are at last beginning to bear fruit, and Professor Baird and his associates are to be congratulated on their success, which has been attended with many difficulties and much unfavorable criticism during the ten or dozen years of untiring labor. Ten years ago salmon were not at all numerous in our Eastern rivers, and shad were so scarce that the man who found twenty of them in a single weir during the season was considered fortunate. In the early part of the last decade shad were almost unknown in the markets. Old fishermen who used to 'drift' for them nights shook their heads gravely as they told of the boat-loads they had caught, and said our fishes were all leaving, never to come back.

"All this time the Fish Commissioners were at work. They went around to the weirs, buying the live fish from the owners, and took them to the breeding establishments, where the eggs were hatched and the young were cared for. After a few years of this work the business was enlarged and eggs and young fish were 'planted' in the headwaters of streams that had none. A few more years passed and the young fish, now grown to maturity, returned to their birthplaces to deposit their eggs, and found good fishways where there had been impassable dams. Laws were passed and enforced that protected the infant enterprise, and the finny tribes came by millions, filling the streams and ponds and adding wealth to the nation.

"This year shad are so abundant and cheap as to be almost a drug in the market, and many a poor family has partaken of that grand old luxury, 'baked shad,' that never tasted it before. With salmon the success has not been so marked, but enough has been accomplished to promise success in the near future, and the gentlemen do not relax in their labors. In addition to these, many ponds, public and private, have been stocked with black bass and German carp, both of which are thriving gloriously. If the work continues ten years longer, there will be more edible fish in the inland waters of the United States than in any other country on earth.

"This means cheap and wholesome food for the people. It also means lots and lots of healthful sport with the rod and reel, just such as we all like, during the warm months that are coming."

That an abundance of fish this year is not confined to this side of the Atlantic will be noticed by the following extract from the Gloucester News of June 2:

"THE NORWEGIAN FISHERIES.—At the Loffoden Islands, on the 4th of April, the yield had been 25,000,000 codfish and 24,000 barrels of cod livers, and 5,500 barrels of medicinal cod-liver oil, steam refined. Last year, at the same time, the yield at Loffoden had been 16,500,000 codfish, 14,700 barrels of cod livers, and 3,450 barrels of medicinal cod oil, steam refined. At other places on Nordland, about 10,500,000 codfish, as against 14,500,000 in the preceding season. Of the total quantity of 35,500,000 codfish caught up to this time, 10,600,000 fish will be prepared as klipfish (dry split fish) and 24,900,000 fish will be prepared as stockfish (dried round fish)."

Number and location of New England fishing fleets on June 1, 1885.

Sail:	
For cod and halibut, on George's and Brown's Banks, in latitude 41° to 43°, longitude 65° 30′ to 69°	180
For cod and halibut, on the Grand Banks of Newfoundland, in latitude 43° 15′ to 46° 35′, longitude 49° to 54° 25′	175
On Banquereau, for cod and halibut, in latitude 44° to 45°, longitude 57° 12′ to 60°	52
On the Western Banks, for cod and halibut, in latitude 42° 55′ to 44° 30′, longitude 59° 25′ to 62° 30′	60
Off the Eastern New England coast, ground fishing	225
Off Greenland and Iceland coast, on halibut trips	11
Fishing for mackerel between Sandy Hook and No Man's Land	240
Total sail	943
Steamers:	
Fishing for mackerel	1
Taking whales off the New England coast	6
Total steamers	7

The number and location of the menhaden steamers will appear later, full returns not having been received.

Catch of codfish at Ipswich Bay, by gill-nets, during May, and landed at—

	Pounds.
Gloucester	31,400
Rockport	98,000
Portsmouth	22,000
Total	151,400

About 300,000 pounds were taken on trawls and landed at Boston, fresh, the nets having been taken up May 12.

Vessels belonging to the port of Gloucester engaged in fishing June 1, 1885.

On the banks, for fresh halibut	41
On George's and Brown's, for halibut and cod	155
On Grand Banks, for codfish	33
On Western and Banquereau, for cod and halibut	51
On fishing grounds off the New England coast, ground fishing	34
On fishing grounds off the New England coast, lobster fishing	6
On halibut trips to Greenland and Iceland	11
On mackerel voyages, mostly now between Sandy Hook and No Man's Land	140
Steamer, mackerel fishing	1
Total	472

Receipts of fish at Gloucester, Mass., in May, 1885.

From—	Fares.	Codfish.	Halibut.	Pollock.	Hake.	Cusk.	Haddock.	Mackerel.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Barrels.*
George's Bank	135	2,452,000	92,450	.....	4,000	4,000	1,000	.....
Northeast Shore	51	516,900	.....	693,000	.....	.....	.....	.....
Brown's Bank	39	1,256,000	33,600	.....	.....	.....	.....	.....
Western Bank	8	282,000	88,000	.....	.....	.....	.....	.....
Banquereau	16	3,000	428,000	.....	.....	.....	.....	.....
La Have Bank	4	49,000	16,000	.....	.....	.....	.....	.....
Grand Banks	2	.....	58,000	.....	.....	.....	.....	.....
Nova Scotia, Cape shore	1	65,000	.....	.....	.....	.....	.....	.....
Off Newfoundland*	1	.....	65,000	.....	.....	.....	.....	.....
Banks†	5	.....	127,000	.....	.....	.....	.....	.....
Mackerel trips south	21	.....	.....	.....	.....	.....	.....	5,579
Total	283	4,623,900	908,050	693,000	4,000	4,000	1,000	5,579

* Off Burgeo, 4 miles from shore.

† Off Sambro, and between La Have and Western Banks, on La Have Ridges.

Other receipts: From nets and traps in the harbor, 419 barrels of herring, from small boats fishing near shore, 14,000 pounds of codfish and 1 halibut. The latter weighed 193 pounds; was caught 5 miles from Eastern Point Light, Gloucester Harbor. Received from Grand Manan, 500 boxes smoked herring.

38.—ON THE RATE OF GROWTH OF THE COMMON CLAM, AND ON A MODE OF OBTAINING THE YOUNG OF THE GIANT CLAMS OF THE PACIFIC COAST FOR THE PURPOSE OF TRANSPLANTING.

By JOHN A. RYDER.

During the season of 1880 I made some observations on the development of the common clam (*Mya arenaria*, L.). These* were published in the report of T. B. Ferguson, a commissioner of fisheries of Maryland for 1881. It was there shown that (1) the spawning season extends from about the 10th of September to about the middle of October; (2) that the eggs and milt may be extracted from the surface of the visceral mass of the adults in the same way as from the oyster, and artificially impregnated; (3) that the early development was very similar to that

* Notes on some of the early stages of development of the clam, or mananose (*Mya arenaria*, L.). In Appendix A of the above-cited report, pp. 83–91, 11 figs.

of the oyster, polar globules being expelled in about the same position as in the egg of the latter, the cleavage being also very similar.

An important morphological point, namely, the precise mode of gastrulation of the embryos of this form was not definitely determined, but it is inferred that in this respect the developing embryo of the clam does not differ essentially from that of the oyster. The development of this mollusk was followed, at the time mentioned, as far as the swimming or veliger stage, beyond which it was found difficult to keep it alive by any means then at the command of the writer. Whether artificial methods of multiplying this form will ever be satisfactory seems very doubtful, but it is obvious that a very simple method may be found available for the purpose of obtaining the young of the clam for the purpose of transplanting the species to new localities to which it is a stranger. This conclusion is supported by the following data obtained in connection with experiments conducted at Saint Jerome's Creek Station in the course of the work at that place on the oyster. These incidental observations show that the animal grows quite rapidly in the course of a few months so that specimens from 1 inch to over 2 inches in length may be expected in about seven months after the spawning season is over, or during the next spring. This has been ascertained as follows:

During the month of February, 1884, a number of ponds were excavated at Saint Jerome's Creek in marsh land for the purpose of oyster culture. These, after serving their purpose for the latter object, were allowed to remain open to the outside water more or less during the autumn, or from September onwards, and it is presumed that in this way swimming embryos of the clam found their way into the inclosures from the outside. That such embryos could not have obtained access in any other way is proved by the fact that the ponds were dug out upon high ground where there had never been any clams before, so that the only possible way in which the young clams could get into the ponds must have been in the way described, the embryos evidently developing from eggs naturally spawned by the adults found buried in the sandy bottom of the channel feeding the ponds. The sexes are separate in *Mya*, or confined to distinct individuals, and the eggs measure about one five-hundredth of an inch in diameter, so that the veliger or swimming stage would be represented by a very small organism indeed. These embryos, after swimming about for some time, would then settle down upon the bottom, develop their characteristic siphon, and bury all but the tip of the latter in the sand. In this situation their growth must be quite as rapid, if not more rapid than that of the spat of the oyster, which, in the space of five months, may grow to the length of 2 inches. Such a rate of growth for the clam is indicated by the size of living specimens obtained from the bottoms of the ponds mentioned above, when the latter were deepened in May, 1885, or about seven months after the last spawning season of the species, which was in Oc-

tober, 1884. In the sandy earth excavated from the ponds, as described above, I found young clams very recently dead, the shells of which measured from 1¼ to 1⅝ inches in length and from three-fourths to seven-eighths of an inch in width, indicating the existence, when the soft parts were entire, of animals ranging from 2 to over 3 inches in length, had the siphon been included in the measurement.

It is therefore clear that if boxes 18 inches or 2 feet square and 3 inches deep were filled with sand and placed on the bottom in the ponds or the open waters, that the embryo clams swimming about in the water during October would find a suitable nidus in which to burrow and grow. After an immersion of six or eight months these boxes could be raised and their contents examined to obtain the young animals, which could be removed from the sand without injury and repacked closer together, siphons upward, in other shallow boxes, which should be immersed in tanks of sea water kept cool in the refrigerating chambers of the transportation cars of the Fish Commission. In this way, if proper precautions were observed in repacking the young mollusks, so as to place them in the sand with the tip of the siphon just above the level of the sand, they could be transported for long distances by rail unharmed and in the living state for the purpose of restocking exhausted beds or areas where the creature had not before existed.

Dr. R. E. C. Stearns, to whom I have spoken of this method of obtaining the young of the common clam, is of the opinion that the young of the giant clams of the Pacific coast might be obtained in the same way. That is, if a number of the old ones could be dug up and replanted at low tide close together and a lot of boxes filled with sand, as described, placed close to such a group of adults during their spawning season, young individuals of either the huge *Schizothærus nuttallii*, or *Glycimeris generosa*, might be got to grow in such boxes. It is not very important that the spawning season of the species named be determined with exactness, for the reason that the boxes will last for several months, even if attacked by the *Teredo*. If the boxes were placed in position, say during the interval between June and September, it is probable that they would be in place in time for the spawning season of the large species named.

Great difficulty has been experienced in handling the giant clams so as not to injure the adults intended for transportation. Such difficulties would be overcome by the adoption of the above method. For an illustrated account of the great clams of the Pacific coast the reader is referred to an article by Dr. Stearns, published in the third volume of the Bulletin of the United States Fish Commission for 1883, (pp. 353–363), where their habitats and conditions of life are fully described, supplying the data needed in order to successfully institute the method of obtaining the young described above.

WASHINGTON, D. C., *June* 13, 1885.

Vol. V, No. 12. Washington, D. C. June 29, 1885.

39.—THE SHAD FISHERIES OF THE HUDSON.

By FRED MATHER.

[Report of a trip to the principal shad-fisheries of the Upper Hudson River, made at the request of Mr. E. G. Blackford, in June, 1884.]

FISHKILL AND NEWBURGH.—These cities, lying opposite each other, were visited on June 5. At Fishkill, John Neal keeps boats to let and has fished for shad for twenty years. This year the water cleared quickly and the season was poor; the run was short and was about over so far down the river. He fished from April 15 to June 1, with drift-nets; did not get one ripe fish this year; some years he has had four or five ripe ones in a day; usually throws them overboard; thinks that on ordinary seasons ripe fish may be got from May 21 to June 1; took about 1,200 this year, and the price averaged 15 cents each.

George Lucas lives at Sherman's Dock, 1 mile north of Newburgh. He says that ripe fish are usually caught about the 25th of May, but he only took three specimens this year. Still, he thinks we might arrange to get eggs with a row-boat from the gill-netters who drift in shoal water. He confirms Mr. Neal's statements regarding a light catch. He took 2,000 fish this year, but usually takes 3,500. He stops fishing June 1. He thinks that 10,000 fish were taken in his vicinity by all fishermen, and that a fair season's work would be about 18,000.

RHINEBECK AND RONDOUT.—These two places are also opposite, and the season's catch was light. Charles Butler says that the highest catch by one boat this year, with drift-nets, was 2,000. He got one ripe fish this season and last year had two or three. F. H. Carr has fished with drift-nets for six or seven years, usually from April 1 to June 10 or 15, and uses two to three boats. He considers that 2,000 to 2,500 to a boat is a fair season's catch; seldom gets spawning fish; only two this year. About twenty boats fish from Rhinebeck and Rondout; some of the men go down to Staten Island at the beginning of the season. About 35,000 shad were taken here this year.

KINGSTON TO CATSKILL.—Between these places the best shad grounds of the purely fresh waters of the Hudson lie. John A. Earls, of Catskill, has fished for eighteen years. Last year (1883) was very good, but this year was bad; in fact, it was the worst in ten years, and did not yield over half the shad that were caught last year. He has taken 2,000 in fishing from the Narrows to Catskill; he drifts in the Narrows and in the Highlands, but uses seines here. The catch of herring (alewives) was as large this year as any, but the catch of shad was below the average. Often takes ripe fish on "Kingston Middle Ground," which is above

Kingston Point about one-quarter of a mile. ("Middle ground" is a term used by the fishermen of the Hudson to denote a bank or shoal in the middle of the river, with a channel on each side. The "Middle Ground" is therefore in shoal water above Kingston.) He thinks that if eggs are obtained here, they must be taken from drift-nets. They fish here in from 30 to 35 feet of water. He has "any amount of spawn" after May 1, and thinks we can get plenty of it. John Pindar, of Catskill, says that the shad catch has fallen off for two years. He fishes with ten seines and fourteen drift-nets, from the Narrows to Catskill, and has taken 7,500 shad; thinks that some ripe fish might be taken in the Highlands, but not enough to pay, because the fish are all dead when taken from the drift-nets. He believes that "Kingston Middle Ground" is the best shad ground on the Hudson, although the catch was not large there this year. Eggs might be got between Rhinebeck (Kingston) and Tivoli. From Catskill I took a row-boat some 3 miles up the river, where Mr. Jonathan Mason was hatching shad behind an island on the eastern shore. He was having good prospects and had a fine lot of eggs. On June 13 his eggs were obtained some 2 miles above, around the northerly point of the island and 4 miles above Catskill, on the western shore. He was getting eggs from Pindar's fisheries.

HUDSON.—At Hudson, Mr. Matthew Kennedy, one of the game protectors of the State, is a large shad fisherman. He employs from twenty to thirty men during the season. He fishes with seines on "Hudson Middle Ground," and the catch this season is the poorest in twenty years. He took between 7,000 and 8,000 shad, but has taken as high as 18,000 (in 1878). Last year's catch was 8,000; in the year before (1882) it was 12,000. Mr. Kennedy thinks that Stockport is the most likely place to get eggs. While here I accompanied Mr. Kennedy on a steamer down to Rhinebeck and below, while he and his men removed and seized twelve pound-nets which were set in the river contrary to law. The fishermen above complained that these nets were injuring the fishing, as no doubt they were, because they fished night and day, while the seines and gill-nets were not in the water all the time. This form of net is new to the shad-fisheries of the Hudson. The previous year two were put in, and their success emboldened others. The raid of Mr. Kennedy will, no doubt, end this form of illegal fishing, as each of the twelve nets cost no less than $150, and some of them cost much more.

STOCKPORT.—This small place lies on the east bank of the river, some 2 or 3 miles above the city of Hudson. Walter Mann fishes here. For nine years he fished with seines, and for the last two has used drift-nets. He does well with the latter at night, and in fact all the gill-netters claim to take the most shad at night; and as this is the time that the fish casts its spawn, it is possible that many eggs may be got from the gill-nets, as is done on the Chesapeake by the United States Fish Commission. Mr. Mann did not take as many fish this year as last, his

catch being only 800, against 1,500 in 1883, a difference of nearly half. Taking a few years back, the fishing has been as good with him as it was ten years ago, except this year, which has been bad. He attributes the falling off to bad weather and the pound-nets set below, which are referred to as being destroyed by Mr. Kennedy. He can get spawners from June 10 to July. This year he stopped fishing on June 9 with seines, but can get fish now (June 13) and with drift-nets for many days longer.

Last year there was a good run of sturgeon, but he did not fish, because he had no nets to take them. (The gill-net for shad has a 5-inch mesh, while the sturgeon net has a mesh four times as large, or about a 10-inch mesh.) Mr. Mann will try for them this year (1884). The catch of striped bass has been good, and he has thrown away over 1,000 of them which weighed less than one pound; that is, returned them to the water alive.

COXSACKIE.—Ed. Alberton thinks that the season of 1884 has been the poorest in many years. He attributes it to the pounds about and below Rhinebeck, which this report shows were removed in the second week of June, and to the backward season. John Malone says that the inferior catch is due to the pound-nets, and does not think the weather had much to do with it. It is certain, however, that the catch of 1884 is far below that of any year within the last decade. He does not know that many spawners can be taken here, because their capture is uncertain. Some years the fishermen get a great number of ripe fish, and again they are scarce. This year they are rare. If fishing was allowed after June 15, more ripe fish would be taken.

CONCLUSION.—From the foregoing interviews, and also from conversations with men in the employ of those named, I learn several things. One is that there is an antagonistic feeling toward the New York Fish Commission because of certain alleged crossings of the shad with the alewife (herring), which they claim has decreased the size of the shad. This is a matter upon which I do not care to write at length, and will simply suggest to those seeking further information to get the views of the fishermen themselves. My well-known objections to the hybridization of fishes may render me incompetent to express an opinion concerning the value of a hybrid whose mother was a shad and whose father was an alewife.

It is certain that the catch of shad in the Upper Hudson for 1884 is lighter than for many previous years. I do not know what it was on the lower river, but as this fish is influenced in its movements by temperature, we may consider that the cold water may have been in conjunction with the causes attributed by the fishermen. It is certain that the shad, which in its migrations is ever on a search for a temperature of 60° Fahrenheit, according to Colonel McDonald, will not ascend our rivers until the melting snows above have spent their vigor, and the temperature at the mouth of the river has gone above 50° and

there is hope of a more congenial warmth above. This, no doubt, often retards the run of shad in the early season and causes a rush and a short catch later on.

Concerning the taking of eggs, it is my opinion that many can be obtained from "Kingston Middle Ground," Catskill, and Stockport, if arrangements are made before the first of June.

40.—AN ACT TO PROTECT THE FISH IN THE POTOMAC RIVER IN THE DISTRICT OF COLUMBIA, AND TO PROVIDE A SPAWNING-GROUND FOR SHAD AND HERRING IN THE SAID POTOMAC RIVER.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after date of passage of this act, for a term of five years, it shall not be lawful to fish with fyke-net, pound-net, stake-net, weir, float-net, gill-net, haul-seine, or any other contrivance, stationary or floating, in the waters of the Potomac River within the District of Columbia.

SEC. 2. That any person who shall offend against any of the provisions of this act shall be deemed guilty of a misdemeanor, and upon sufficient proof thereof in the police court or other court of the District of Columbia, shall be punished by a fine of not less than ten dollars nor more than one hundred dollars for each and every such offense and shall forfeit to the District his nets, boats, and all other apparatus and appliances used in violation of law, which shall be sold; and the proceeds of such sales, and all fines accruing under this act, shall be paid into the Treasury: *Provided*, That nothing in this act shall be construed to prohibit angling or fishing with the out-line or to prevent the United States Commissioner of Fish and Fisheries, or his agents, from taking from said waters of the Potomac River in the District of Columbia, in any manner desired, fish of any kind for scientific purposes or for the purposes of propagation.

SEC. 3. That from and after three months from the date of the passage of this act it shall be unlawful to allow any tar, oil, ammoniacal liquor, or other waste products of any gas-works or of works engaged in using such products, or any waste product whatever of any mechanical, chemical, manufacturing, or refining establishment to flow into or be deposited in Rock Creek or the Potomac River or any of its tributaries within the District of Columbia or into any pipe or conduit leading to the same; and any one guilty of violating this section shall on conviction as provided in section two of this act, be fined not less than ten dollars nor more than one hundred dollars for each and every day during which said violation shall continue, to be prosecuted for and recovered as provided in the preceding section.

Approved, March 2, 1885.

41.—ON THE GREEN COLORATION OF THE GILLS AND PALPS OF THE CLAM (MYA ARENARIA).

By JOHN A. RYDER.

Mr. W. Williams, collector of the port at Stonington, Conn., recently forwarded from there five specimens of the common clam to Professor Baird, with the request that he would have them examined and report upon the nature and source of the pigment which tinged the gills and palps with a disagreeable bluish-green color. In his letter of December 31, 1884, Mr. Williams says: "I forward you this day some clams for examination, [in order to ascertain] the cause of the 'greening,' as per your letter of November 28, 1884. Parties here are afraid to use them on account of the 'greening.' Will you please report, so I can have your answer published and settle the question [raised] as to their unhealthfulness as food?"

Strangely enough—in spite of the fact that it has been repeatedly stated by competent chemists, such as Berthelot,* Endlich,† and others that chemical research had failed to detect metallic substances such as copper—dealers, oystermen, and the public still persist in holding to the belief that there is really some green metallic salt of copper present, as evidenced by the fact that oysters when "green-gilled" have a coppery taste. The experiments of Puységur and Decaisne have shown how groundless this belief is, and have demonstrated beyond a shadow of doubt that if the proper food material was selected and brought within reach of the living animals, other food being excluded, they could cause individuals, the flesh of which was known to be colorless before the experiment was tried, to become greenish. These same animals, when subsequently deprived of what might be called their *viridigenous* diet of *Navicula ostrearia*, variety *fusiformis*, lost their viridity entirely in a few days and again became white-fleshed.

This viridity I have noticed in living oysters sent me from France and England. Three species similarly affected, that is, with the gills, heart, or mantle more or less discolored by the absorption of a soluble pigment alluded to elsewhere,‡ have fallen under my observation.

MM. Puységur and Decaisne have traced the viridity which discolors the flesh of the oyster to its source, and, as stated above, have experimentally proved that it could be artifically induced and removed under the requisite conditions. The writer's share in completing the history

* See Ann. Report U. S. Commissioner of Fish and Fisheries, Part X, 1882, p. 793, "On the Cause of the Greening of Oysters," by M. Puységur.

† Bull. U. S. Fish Commission, I, 1881, p. 413, in "Notes on the Breeding, Food, and Green Color of the Oyster."

‡ Ann. Report U. S. Fish Commissioner, Part X, 1882, pp. 801–805, "Supplementary Note on the Coloration of the Blood Corpuscles of the Oyster"; also in Am. Naturalist, 1883, pp. 87, 88.

of this singular, abnormal phenomenon, and showing that the discoloration first affects the mobile tissues of the animal contained in its vessels, that is, the blood-cells and the watery serum in which they float, was the histological and physiological part of the problem. MM. Puységur and Decaisne did not apparently perceive that they were dealing with a pigment which was not truly chlorophyl. This fact the writer would again point out, giving reasons therefor which he has not hitherto stated elsewhere:

1. The discoloration is progressive in its advance from the vascular system to other parts, the gills being first affected, then the heart, and finally the mantle and body-mass. The discoloration is diffuse, not confined to chlorophylloid granules, as in plants or in other animals in which such distinct granules are actually found. Nor is it ever in any case lodged in corpuscular bodies of any sort, except throughout the whole body of the cells found in the vascular canals or the cells entering into the formation of the edible connective tissues of the oyster. This tendency gradually to diffuse itself shows that this pigment must be in solution in the blood-serum. The experiments of MM. Puységur and Decaisne show that it is not destroyed in the process of digestion, as chlorophyl seems to be by the action of the gastric juice in the stomach of vertebrates, in which case it never, at least in herbivorous forms, has been known to discolor the blood. Chlorophyl in plants is contained in intracellular plasmic bodies, which are not destroyed when the coloring matter is removed. Sachs* says: "The coloring matter contained in each chlorophyl body is itself only extremely small in quantity; after its removal the protoplasmic basis retains not only its form, but also its previous volume. The latter is always a continuous soft substance, containing extremely small vacuoles, in which the coloring matter is generally distributed universally, though not always uniformly." The diffuse coloration of *Stentor cæruleus* amongst infusorians seems to be somewhat similar to the "azure blue" color found by Puységur in the "intracellular liquid" of *Navicula ostrearia*. This brings us to the consideration of the second piece of evidence opposed to the conclusion that the pigment which discolors clams and oysters is chlorophyl.

2. The discoloration of the flesh of the clam and oyster is not distinctly green, but bluish-green. Only at times have I observed that the blood-cells lodged in the heart were of a light pea-green color in the latter. This bluish-green color I have seen very strongly expressed in *Ostrea angulata* and in specimens of *O. edulis*. It is, therefore, reasonable to conclude that the pigment, which is imbibed by the plasma of the parts affected, is truly something different from ordinary green chlorophyl. Phycocyanin, or a kindred vegetable pigment, as elsewhere stated, seems to be the substance which is absorbed by the tissues affected.

* Text-Book of Botany, 2d Eng. ed., p. 45.

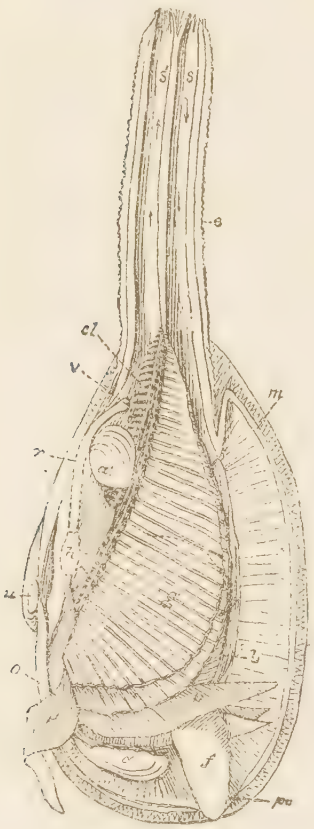
The only organic pathological changes which the writer has hitherto observed to accompany this discoloration, as one of its effects, is the lodgment of the tinged blood corpuscles in the depressions between the muscular trabeculæ of the cardiac walls. Sometimes these corpuscles, thus arrested in the ventricular chamber of the heart, form a thick adherent coating over the inside of the ventricle. The arrest of corpuscles, and their accumulation in cysts developed in the vicinity of vessels in the mantle, also occur, but this condition seems to be a rare one. When freed from the cavities in which they have been arrested, these blood corpuscles are very easily dissociated, if the animal has been previously hardened in alcohol or chromic acid. Microscopic examination shows them to be blood corpuscles, which belong to the animal in which they are found, and not foreign parasitic bodies of a vegetable nature, as is proved by their size, structure, and non-possession of cellulose walls.

What has been said above relative to the source and nature of the discoloring pigment abnormally present in the tissues of the oyster as a diffusable substance applies also to the substance which has discolored the gills and palps of the specimens of clams sent from Stonington, Conn. During the last three years the writer has frequently been told by fishermen and oystermen, at different localities along the eastern coast, that the flesh of clams was sometimes discolored much in the same manner as that of oysters; but until recently no opportunity has presented itself to study this condition in the clam. Skeptical at first, the Stonington specimens demonstrated very clearly to the writer that the nature and source of the discoloring pigment are very similar, if not identical, in the cases of both the oyster and the clam.

The researches which have been made upon the Stonington specimens were conducted as follows: A pipette was thrust into the mouth and stomach, to get some of the food materials; some of the contents of the rectum of several individuals was also examined. The result was that very little could be determined as to what had been the food of the animals, except that diatoms had been consumed in moderate quantity. There was no great abundance of empty diatom frustules, such as is sometimes observed in the oyster. These diatoms were all navicular in form, but belonged to several different species, so that it was impossible, with the material at hand, to find out which one had supplied the coloring matter, because the soft material had been dissolved out of the frustules entirely, leaving them colorless and empty. Other *débris* among the contents of the rectum showed that fragments of small arthropods had been swallowed.

The investigation of the soft parts which had been discolored was more satisfactory, because in these cases the method of microtomy was applicable. But before entering upon a discussion of this aspect of the investigation it may be well to describe the condition in which the specimens reached the writer, and in what way they were affected.

The specimens arrived in a living condition, and appeared perfectly healthy, except that the gills and palps were discolored and had a dirty bluish-green cast, which was in striking contrast with the color of these parts in unaffected specimens. A better understanding of the parts involved by this discoloration may be had by reference to the accompanying figure taken from Woodward's Manual of Conchology. The gills *g* and palps *p p* of the figure were the parts to which the discoloration was confined. No other part of the tissues of the animals seemed to be in the slightest degree affected. Fresh water seemed to have a tendency to bleach the gills when the animals were placed in it for a time. Preparatory to microtomical work upon the gills, the animals were first killed in weak alcohol, then slowly hardened in the same liquid, and finally small fragments of the gills were put into absolute alcohol. During all of this treatment the gills lost but little of the color which permeated them. Subsequently the pieces which were to be cut into sections were saturated in clove-oil, then transferred to chloroform, which was changed once, with still no evident loss of the color. The pieces of the gills were then heated in a mixture of paraffine and chloroform to a temperature of about 160° Fahr., without destroying their coloration. The paraffine and chloroform were finally replaced by pure paraffine, in order that the objects might be thoroughly saturated and the more readily cut into thin sections. No staining reagent was used, because it was thought that the coloration due to the absorbed vegetable pigment would still be evident in the sections. A foreign pigment used to dye the sections would have vitiated the results and made it impossible for one to see if one set of tissues had been stained more deeply than another by the color imbibed during life. The result showed that there was but little difference in the depth of the color of different layers. The blood-cells seemed slightly darker in color, but all of the tissues of these sections, which were cut in a transverse direction, were more or less deeply stained and of a dirty greenish color.



No evidence of the existence of minute parasitic animals or plants was observable either on the outside or in the internal cavities of sections prepared from the gills.

My investigations have therefore led me to the conclusion that the

cause of the acquired green color of the clam is the same as that of the oyster; that, as in that animal, it is diffuse; is absorbed from the vegetable food consumed by the animal; that it is allied to, if not the same as, phycocyanin; that it is harmless, as has been experimentally demonstrated in the case of the oyster. There is also no reason why green clams should not be as freely consumed as food as green-fleshed oysters, which are valued all the more by the epicures of Paris and London because they are so discolored, in the belief that such a change of color improves their flavor.

WASHINGTON, *January* 8, 1885.

EXPLANATION OF THE FIGURE.

Side view of the soft parts of the common clam or mannanose (*Mya arenaria*) in the position in which it is found in life, with the left valve and mantle of the left side removed and the left half of the siphon cut away, so as to expose its incurrent and excurrent canals.

a, anterior, *a'*, posterior adductor muscles; *b*, body-mass; *cl*, cloacal cavity, continuous posteriorly with the suprabranchial chamber; *e*, wrinkled horny epidermis of siphon; *f*, foot; *g*, gills; *h*, heart; *m*, cut edge of the border of the mantle where it is continuous with that of the left side; *o*, mouth; *p p*, palps or lips; *p o*, pedal opening in the mantle, through which the foot is extended; *r*, rectum; *s*, incurrent siphonal canal; *s'*, excurrent siphonal canal (the arrows indicate the direction of the current flowing in and out of the mantle chambers of the animal); *u*, umbo next the hinge of the right valve; *v*, vent or anus, which opens into the cloaca.

42.—THE MIGRATION OF SALMON (SALMO SALAR L.) IN THE BALTIC.*

By JUDGE FIEDLER.

As most people know, the salmon-fishery in Denmark is limited in territory; only at and below Bornholm and Christiansöe has there been carried on from time immemorial quite a considerable hook-fishery for great salmon. The salmon-weirs in Gudenaa and Skjernaa, at Kolding, Veile, and many places, all have greater importance for the capture of sea-trout (*Salmo trutta*) than for the salmon itself (*Salmo salar*), for which the streams of our little country are too small and shallow to furnish the desired spawning-grounds. It is only on the island of Bornholm that they are found in a little rivulet and a few larger brooks, which might furnish a refuge for the sea-trout, but are not suitable as spawning-places for the salmon, and there is no information that the salmon ever came into them for the purpose of spawning. The salmon which are caught off Born-

* Comments in *Nordisk Aarsskrift for Fiskeri*, 1884, upon "*Laxens* (*Salmo salar* L.) *Vandringar i Ostersjön*," by Professor Andreas Johan Malmgren, in *Norsk Fiskeritidende*, Part II, April, 1885; pp. 210–215. Translated from the Danish by TARLETON H. BEAN, M. D. For Professor Malmgren's article, see Bull. U. S. F. C., 1884, pp. 322–328.—EDITOR.

holm, whether great salmon or small salmon, must have been hatched in the places closely bordering thereon, and migrated there from the numerous streams and rivers of Sweden and Finland emptying into the Gulfs of Bothnia and Finland; certainly also from the Russian, Polish, and German rivers—for example, the Oder—which flow into the eastern portion of the Baltic; for there is absolutely no reason for accepting the assertion of many Bornholm fishermen that the salmon breeds also in the sea in that vicinity, which assertion is supported by the statement that the water is fresh enough for the capture of small salmon, reaching, in a solitary case, three-quarters of a pound in weight, and they say that they have frequently seen salmon eggs on the algæ and the small stones associated with them on the sea bottom. Other things are necessary besides fresh water to furnish a suitable spawning-place for salmon; and the supposed salmon eggs which have been shown to me for some years on *Fucus* were certainly something very different. The presence of small salmon, which is traced far to the westward in the Baltic, even into the southern portion of the Great Belt, shows simply that the young salmon can leave the place of their birth earlier to develop into the adult condition in the sea. For a detailed description of the Bornholm salmon-fishery attention may be called to a treatise written by V. Skrydstrup, school inspector, which is printed in the Norwegian Fishery Journal, volume 2, page 15 *et seq.* Since the capture of salmon in Denmark, as a matter of course, is necessarily much smaller than in Sweden and Finland, and as the greatest portion of our catch is exported whole, it is not to be wondered at that we fail to find such hooks in the salmon taken as occur so frequently in the neighboring countries mentioned, and which Professor Malmgren has had the opportunity of bringing to light; and still it appears probable that they must occur off Bornholm, which lies within the usual range of the salmon and so near to the North German coast of the Baltic. However, it may be due as much or perhaps more to the want, in discoverers, of a knowledge of the scientific importance of such a find that nothing of the kind has been reported. At least nothing has come to my knowledge during the many years of my relation to the fisheries, and I have inquired vainly hitherto at Bornholm whether any such thing has occurred; but it is not impossible that this may have happened and gone unnoticed.

Under these circumstances it is fortunate that an accident enabled me to secure possession of a somewhat compressed brass hook which was found in a salmon weighing about eighteen pounds, caught late in April of this year in the Great Belt south of Korsör. This hook is, so far as indicated by its size and form, found, upon comparison, so entirely like the one described and figured by Malmgren as Fig. 2* that there can be no doubt that the salmon must have swallowed it and carried it from the North German coast of the Baltic. It differs from Fig. 2 only in having

* Bull. U. S. F. C., 1884, p. 323.

attached to it a slender line composed of six linen threads 13 inches in length from the hook to the place where it is broken, and 2¼ inches below the fracture is a lead sinker, without perceptible lettering, fastened in the same manner as in Fig. 3, but different from this in being 10¾ inches (not "a few" inches) distant from the hook. The salmon here mentioned was caught in a seine along with another of equal size and weight. The fishermen supposed them to be male and female. The salmon therefore extends its migration considerably farther than to the sea about Bornholm. It is worth while to add here besides, as something entirely unusual, that not a few great salmon have appeared this spring prepared to ascend the Great Belt, all caught in the seines set for herring, which are placed near the coasts, only far enough out to have the head of the net in a depth of from 2½ to 4 fathoms, in the region from Karebæksminde to Korsör. The great salmon thus accidentally caught had, against their custom, gone into the shallow water, and we would appear to be justified in supposing from this that a larger number may have been in the deep water. Since within the memory of man, extending over a period of more than fifty years, so far as I can learn, a single great salmon is exceptionally caught at intervals of more than ten years in a seine. The greatly increased occurrence of salmon this year is a phenomenon which may possibly be attributed to the unusually mild winter, which kept the larger western portion of the Baltic, with its adjacent sounds and gulfs, free from ice all winter. Of the two salmon, weighing 16 pounds each, caught at Visserup on the last day of April, this year, I had the opportunity of opening one, and found it to be a female with the ovaries developed to a length of 5⅛ inches, while the eggs were as large as mustard seed. In its alimentary canal no trace of food was found, and there was no evidence that it had taken any food for several days before its capture. It was a plump and vigorous fish, which seemed to have a stronger desire to gratify its roaming propensity than a necessity for obtaining sustenance. Small salmon appear here, sparingly to be be sure, but still far more plentifully than great salmon, and usually in small schools. Thus there were caught at Visserup some years ago thirty-seven individuals at one time, weighing from 2 pounds to 6 pounds each. It appears to me that there is strong ground for attributing this circumstance to the fact that the salmon frequent the great Baltic basin westward of Bornholm much more regularly than is usually supposed; and I believe that the foregoing statement should encourage the fishermen of South Seeland and Smaaöerne to attempt salmon fishing along their coasts. When we consider the salableness of this valuable fish at high prices, and the comparatively small outlay for procuring the necessary apparatus, we shall see that not much of a return is required to make the fishery remunerative. At all events, the experiment, which so far as I know has not yet been undertaken in this direction, ought to be made. So far as concerns the statement of Malmgren that the salmon-fishery during the last ten years has increased considerably at Bornholm and on the North German coast of the Baltic, and his attributing

the increased supply of salmon in these places to the establishments for their preservation which have been instituted for the streams of Finland, this conclusion may, of course, be entirely justified; but so far as Bornholm is concerned, from which place I have recently obtained information from reliable men, I cannot omit adding a few words which are worthy of consideration in this connection.

It will be advantageous to distinguish between great salmon and small salmon (the last from 1 to 4 pounds). The first are caught almost exclusively in deep water by means of hooks; the latter, nearer to the shore in nets. The first are naturally the most valuable; the last, however, are salable at a weight of 2 pounds. Nevertheless it must be admitted that every measure looking toward the prevention of the capture of young salmon until they reach a weight of 5 or 6 pounds must be considered appropriate. Concerning the great salmon, the people of Bornholm do not recognize any advancement in the fishery in the last ten years; on the contrary, they maintain that there has been a decline, which manifests itself both in the yield and in the number of fishermen employed in the salmon-fishery. The last winter has indeed been somewhat better than the winter before, nevertheless it is said that many fishermen have not caught enough to repay them for the loss of apparatus. No new salmon boats have been built within the last year. Several decked boats have been reconstructed as well-boats for the cod-fishery (three from Neröe alone), and the salmon-fishery, so far as these are concerned, must be considered ended. It is possible, they say, that the net fishery for small salmon may have increased somewhat of late years; but according to Skrydstrup, who wrote ten years ago (see *Nordisk Tidsskrift for Fiskeri*, vol. 2, p. 29), it was at that time unimportant, while at a still earlier period it was carried on more extensively. People do not now attach much importance to the belief that the decrease of small salmon is injurious to the fishery. According to my opinion, however, they mistake in this; and I find that there is every reason to recommend all contrivances that serve to restrict the capture of young salmon, and to postpone the fishing until the salmon are larger and heavier. In consequence of this I entirely agree with Professor Malmgren on the desirability of an international agreement for the prevention of the capture of young salmon in the Baltic. Although I do not overlook the difficulties in having the measures necessary to this end agreed upon and carried out, I think that much may be done by establishing a minimum size of mesh for the nets, whether they are used as set-nets or drag-nets, which will prevent the capture of small salmon under 3 or 4 pounds in weight. It seems that an agreement in this matter should not be difficult to reach. As for the efforts towards improving the Bornholm salmon-fishery by the aid of artificial hatching, the utility of this plan seems to be exceedingly doubtful, because of the circumstance already mentioned, that the island lacks rivers and contains only some small streams which are well enough adapted for the reception of trout but not for salmon.

43.—NOTES UPON OCTOPUS, FLYING-FISH, ETC., TAKEN DURING THE ALBATROSS CRUISE IN JANUARY, 1884.

By WILLARD NYE, Jr.

OCTOPUS, ROCK SQUID, OR SEA CAT CAUGHT AT ST. THOMAS.—When first seen it was on the shore side of a coral reef in water about one foot deep; the ends of its arms were coiled up nearly to the membrane between them, which membrane was well extended. It appeared to take very little notice of a person moving around in the water or on the reef within three or four feet of it, until it was touched, when it took hold of the bottom and moved slowly to the coral reef and fastened to it with its arms. On being poked with a stick it let go with two arms, extended them along the opposite sides of the stick, and took such a firm hold of it that a pull of from 100 to 150 pounds failed to get the stick away. If the pulling was kept up it soon seemed to become exhausted and suddenly let go of the stick, but on again being touched it would take hold once more. In no case did it use more than two arms for seizing the stick, the others all the while being attached to the reef. When first thoroughly aroused it ejected a black liquid, but although severely poked around in the water for five or six minutes, it did not again throw out any colored fluid.

FLYING-FISH.—When flying they move their fins very rapidly, much like a bumble-bee. They seem rather to prefer flying to windward than the opposite; and sometimes, in a stiff breeze, they will rise and fly to windward from 30 to 40 yards. They do not seem to be attracted to any great extent by a light held a few feet from the water; but if the electric light is lowered beneath the surface a few inches and kept stationary they come around to investigate, and at times seem to become much excited about it. I do not think that their flying on board a vessel is because they are attracted by the lights, but rather because they get flurried, and not having that control of their course that a bird has they sometimes drop on deck rather than into the water.

FISHING AT ST. THOMAS.—Most of the fish are taken in traps or pots, some of which are nearly if not quite ten feet in diameter. They are mostly in the shallow bays and lagoons, where the water is from 5 to 15 feet deep, and also in the lee of the breakers on the numerous points. Many fish are taken by trolling with hook and line, baited with a small fish or a piece cut from a large one. Even the large fish do not seem to be much afraid of getting in shallow water, which may in part be due to the fact that the rise and fall of tide is very slight. The tackle used in fishing would be considered by us as rather coarse and clumsy.

OCTOPUS, OR SEA CAT, AT CURAÇOA.—During the day they remain in the cracks or under the coral and stones, but come out at night to

feed, when many may be captured in the shallow water along shore, often when it is not more than two or three inches deep. They have a peculiar translucent whitish appearance in the night-time. They can move themselves quickly over the stones either in or out of the water, but do not seem to be alarmed by a person moving around near them, either in the day or night, unless they are touched or otherwise disturbed.

PORT OF SPAIN, TRINIDAD.—Many of the fish for market are caught in seines on the flats off the mouth of the Caroni River. Some of these fish very nearly resemble our alewives. These flats extend half a mile or more from shore, the water being from a few inches to three or four feet deep. They are of mud near the shore, but gradually change to sand as you get farther out. Fish are very abundant over them, and it is also a great fishing ground for the herons, pelicans, &c. Many fish are also caught with hooks and lines along the shore, both by still-baiting and by trolling.

44.—PROPAGATING BUFFALO-FISH.

By A. A. MOSHER.

[Letter to Prof. S. F. Baird.]

In experimenting with the common buffalo-fish, (which is very common here and grows to weigh as much as 60 or 70 pounds,) I found no difficulty in propagating them. I took several of both sexes, when about ready to deposit their eggs, and put them in a small sunken place about 15 feet square and 18 or 20 inches deep, gravelly bottom, with cane-grass growing all through it. I paid no attention to them except to take them out after spawning. In the fall I found thousands of small buffalo about 1½ inches long, notwithstanding there were two large black bass there all the time. I write this to show what can be done with this fish. I do not consider the buffalo a good edible fish, it being generally coarse and oily. They could be propagated advantageously, and serve as food to be given to game or edible fishes.

When the water begins to grow warm, after the ice goes out, these fish are around the shores in immense quantities; they are in bunches of from three to seven or eight, the female is in the center, and when she sinks to the bottom to deposit her eggs, the males crowd around and under her, pushing her to the top of the water, until their tails and fins are out, then they make a tremendous rush, causing the water to foam, and with a noise which can be heard on a still evening a mile. They go ahead for a few rods, then sink, and the same performance is done over. The people call it "tumbling;" in fact, it is a sight which once seen will never be forgotten.

SPIRIT LAKE, IOWA, *April* 24, 1885.

45.—NOTES ON FISHES OBSERVED IN LAKE SUPERIOR.

By DAVID S. JORDAN.

In a recent brief visit to Lake Superior (Marquette, Munising, Sault Sainte Marie) some observations were made on fishes obtained by the fishermen in pound-nets and seines. The following is a list of the species seen, only fourteen in number. It embraces, however, most of the species commonly taken in the lake. Although the waters of Lake Superior everywhere abound in fish, the number of different species represented in its fauna is very small.

1. **Acipenser rubicundus** Le Sueur. *Sturgeon.*

Seen in the market at Marquette. Not studied by the writer.

2. **Catostomus catostomus** Forster. *Red sucker.*

Everywhere common. Seen ascending the streams in great numbers, apparently for spawning purposes (July 1). Many adult specimens in rocky pools about cascades in streams running into the lake. Males with a bright red band along the sides.

3. **Catostomus teres** Mitchill. *Common sucker.*

Common in the lake, and at Sault Sainte Marie.

4. **Catostomus nigricans** Le Sueur.

One large specimen seen at the Sault.

5. **Coregonus clupeiformis** Mitchill. *Whitefish.*

Everywhere abundant; taken chiefly in the pound-nets.

6. **Coregonus labradoricus** Richardson. *Sault whitefish.*

Found in enormous numbers early in July ascending the rapids at Sault Sainte Marie. Taken by the Indians in dip-nets. Most fishermen apparently do not distinguish this species from the common whitefish, and no discrimination is made between the two species by consumers. The river whitefish is a smaller fish than *C. clupeiformis*, more elongate, and the flesh is less fat, drier, and less agreeable to the taste. In fresh specimens of this species the teeth on the tongue are very evident. The lower jaw is always shorter than the upper. The coloration is darker than that of the lake whitefish.

7. **Coregonus artedi** Le Sueur. *Lake herring.*

Everywhere very common, in great schools near shore.

8. **Salvelinus namaycush** Walbaum. *Mackinaw trout; Lake trout.*

Everywhere abundant. Taken by trolling and in the pound-nets. Extremely variable in markings and shade of coloration. The form or species called siscowet (*S. siscowet* Agassiz) is found only in deep water.

9. Salvelinus fontinalis Mitchill. *Brook trout.*

Everywhere. Specimens taken in Lake Superior are larger than brook examples, often reaching a weight of four or five pounds. The specimens found in the lake are paler, duller, and more silvery in color than those taken in the streams.

10. Esox lucius L. *Pike.*

Common.

11. Perca lutea Rafinesque. *Yellow perch.*

Seen only at the Sault Sainte Marie.

12. Stizostedion vitreum Mitchill. *Wall-eyed pike.*

Seen only at the Sault.

13. Uranidea richardsoni Agassiz. *Dogfish.*

Said to be common in the lake. One specimen secured. This is evidently specifically identical with specimens from Southern Missouri and the Ohio Valley. Compared with specimens from Southern Missouri the example from Marquette is a little more slender, the coloration a little less definite, being a little darker, with fainter cross-bars, and more conspicuous dark punctulations. The vent is similar in position in all, contrary to the statements of Girard, who finds the vent further back in examples from Lake Superior (Original types of *Cottus richardsoni*). D. VIII—18, A. 12.

14. Lota lota L. *Lawyer; Loche.*

Common.

INDIANA UNIVERSITY, BLOOMINGTON, IND., *July* 11, 1885.

46.—REPORT UPON THE SHAD AND HERRING FISHERIES OF THE POTOMAC RIVER FOR 1885.

By GWYNN HARRIS.

Number of shad landed at Washington	125,408
Number of shad landed at Alexandria	19,189
Number of shad shipped to Baltimore per steamer	8,800
Number of shad sold on the shores and from trap-nets	4,300
Total	157,697
Number of herring landed at Washington	9,814,033
Number of herring landed at Alexandria	3,911,186
Number of herring sold on the river shores and from trap-nets	1,700,000
Number of herring shipped to Baltimore by vessels	71,800
Total	15,497,019

Vol. V, No. 13. Washington, D. C. Aug. 11, 1885.

47.—COMPARATIVE EXAMINATION OF CULTIVATED AND UNCULTIVATED OYSTERS, WITH THE VIEW TO DETERMINE THE NUMBER WHICH, DURING THE FIRST YEAR, TOOK PART IN REPRODUCTION.*

By Dr. P. P. C. HOEK.

I have already mentioned in this report that in my investigations of the genital organs of the oyster I had not had an opportunity to ascertain the number of individuals which produce young ones during the first year. At the same time I advanced the opinion that it was very likely possible that in this respect there was a noticeable difference between cultivated and uncultivated oysters.

Baron Groeninx van Zoelen and Baron G. H. Clifford, oyster cultivators on the East Schelde, after reading my statement, offered me a sufficient quantity of oysters of both kinds for making comparative studies. This offer, which was particularly agreeable to me, and which I could not appreciate too highly, was eagerly accepted by me. Toward the end of June, 1883, I received 200 oysters from a locality where cultivated oysters had uninterruptedly been planted for a number of years; and also 200 oysters gathered in waters† belonging to an oyster region which they had rented for years, but where no oysters had ever been planted. I confined my investigations to these 400 oysters, although more were offered me. In my opinion a larger number—say 800—would not have formed a more reliable basis for my conclusions; and, moreover, my time was too limited to extend these investigations very much. They have, therefore, only a comparatively small value as regards the comparison between cultivated and uncultivated oysters. I nevertheless determined to publish the results of my investigations, because I deem it important to ascertain exactly the condition of the sexual organs of a certain number of oysters at the beginning of the period of reproduction.

I am by no means the first to appreciate the importance of similar investigations, nor am I the first to make them. Not to go back to older authors, I must refer to Mr. Gerbe‡ and Professor Möbius. Mr. Gerbe

* "*Vergelijkend onderzoek van gekweekte en in het wild opgegroeide*" *oesters, ingesteld ter bepaling van het aantal dat per jaar aan de voortplanting deelneemt.* From *Tijdschrift der Nederlandsche Dierkundige Vereeniging*, Supplement No. 1, Leyden, 1883–84. Translated from the Dutch by HERMAN JACOBSON.

†These waters are called "Geul;" they are situated northeast of Yerseke, and their depth is about 33 feet.

‡Z. Gerbe: "*Aptitude qu'ont les huîtres de se reproduire dès la première année,*" in *Revue & Magas. de Zoologie pure et appliquée*, 3d series (Guérin-Méneville, Paris), IV, 1876.

endeavored to solve the problem whether oysters already produce young ones during the the first year of their life, and he found among 435 one-year-old oysters 35 which had spawn in their branchiæ, 127 which had eggs in the ovaries, and 189 having spermatozoa; there were, therefore, only 84 which during this first year did not show a pronounced sexual development. (It remains to be seen whether the oysters containing eggs or spermatozoa would exercise the sexual functions during the year when the investigation was made.) Professor Möbius* examined 300 oysters taken on May 25, and found 18 per cent in a stage of sexual development approaching one of the two sexes, while of the remainder (82 per cent) one half contained eggs, and the other half spermatozoa. He does not state what method he pursued, which is to be regretted, because the value of the results obtained depends entirely on this method. I have, therefore, deemed it necessary to follow the somewhat difficult method described below.

First of all I ascertained the age of every oyster that I examined, and noted at the same time whether it had been taken from a tile, from a shell, or from a stone. I gave a number to each oyster, while a piece of each was put in alcohol for farther examination. Later I took a small fragment of each piece and stained it, for microscopic examination.

The oysters examined by me were opened between the 16th and 28th of June, and as the piece taken from each was immediately put in alcohol, my examination enabled me to judge of the condition of the sexual organs on the day the oysters were opened. I must confess that the preparation of a similar fragment frequently did not answer the purpose and did not always yield a decisive result. Some oysters had spawn in the beard; they had exercised the functions of females in the course of the year. Others contained a large number of mature or nearly mature eggs, and would have deposited these eggs in a few days during the following month or later.† Others again contained mature or nearly mature spermatozoa; they evidently were going to participate in the spawning process during the season. On the other hand, oysters containing young cells producing eggs, and mother cells of spermatozoa, possessing, therefore, the two elements in a rudimentary state of development, are in a stage when it is extremely difficult to ascertain whether they will take part in the spawning process of the season, and what their function will be. According as the male or female element seemed to prevail, I determined them as being inclined to become either males or females. There were finally some oysters (their number was not very large) whose sexual organs were but little developed; it was impossible to state with certainty if these oysters had already performed sexual functions, or whether they were in a sick or feeble con-

*Karl Möbius: "*Die Auster und die Austernwirthschaft*," Berlin, 1877, Wiegandt, Hempel, & Parey.

†There is no doubt that the temperature of the water either accelerates or retards the spawning process.

dition. The presence in the organs of sexual products in small quantity and in a weak state of development made it still more difficult to reach a conclusion; one thing, however, seemed to be certain, that they had not yet performed the functions of males.

Of 200 only 10 were lost, which 10 either appeared dead when the shells were opened, or whose shells contained nothing but sand, or else the piece that was laid aside spoiled because of the evaporation of the alcohol before the microscopic examination could be made.

The results obtained by an examination of 190 oysters of each kind are given in the following table:

Condition of sexual organs.	Cultivated oysters.	Uncultivated oysters.
A. Oysters with white spawn	11	19
B. Oysters with black spawn	17	12
C. Oysters with mature or nearly mature eggs	21	42
D. Oysters with mature or nearly mature sperm	75	94
E. Oysters with organs inclined to become female	11	7
F. Oysters with organs inclined to become male	17	6
G. Oysters with organs little or not at all developed	38	10
Total number of oysters examined	190	190

Of the number of 190 cultivated oysters, at least 49 performed the functions of females, and of the uncultivated at least 73. These figures show an excess of 12½ per cent of uncultivated oysters. The specimens classed under E, which are more numerous as regards the cultivated oysters, should, however, properly be classed among the females, and the difference would therefore be less. As, moreover, among those of class G several had doubtless already performed the functions of females, and as therefore there must be more of these among 38 than among 10, the difference as it presents itself at first loses all significance. The same applies to the oysters with sperm. The excess is on the side of the uncultivated oysters, but this excess is so small that any conclusion based on these data would not be reliable.

In consulting this table one thing will at once become apparent, namely, that at a certain period of the season the cultivated oysters are ahead of the uncultivated, as regards their development. Generally an equal number of each kind was sent to me, so that they may be considered as having been opened at the same time. Presuming that of those classed under G one-half had performed the functions of females, the oysters which had already performed these functions and those which were about to perform them should be classified as follows:

	Cultivated.	Uncultivated.
Oysters with ripe or nearly ripe eggs	21	42
Oysters with white spawn	11	19
Oysters with black spawn	17	12
Oysters which had deposited spawn	19	5

The table shows sufficiently that in the specimens which were examined the cultivated oysters exceeded the uncultivated. This observation is confirmed by the assertion of oyster cultivators, namely, that uncultivated oysters deposit their spawn later than the cultivated. In oyster regions where it is certain that the large mass of spawn to be gathered comes from uncultivated oysters, the tiles are laid some time after those placed in regions destined for cultivated oysters.

As regards the age which is necessary for reproduction, my investigations did not lead to any definite result, because nearly all the oysters which I received were of the same age. The majority were three or four years old, and some two or five years old. Even if there had been a greater difference of age, the number of oysters would have been much too small to yield absolutely certain results as regards this question.

In conclusion, I must state my opinion as to the manner in which these investigations should be carried on in order to reach a sure result. The investigations should commence in March and be continued till October. Every month about the same date a sufficiently large number (at least 100) of oysters, two, three, and four years old, should be opened—an equal number of each kind, cultivated and uncultivated. An incision which will solve all doubts as regards the sexual organs should be made in each oyster. Only such a process would furnish figures which could allow a comparison.

Supposing for a moment that the result would be that the number of females did not differ much in each kind, it would still be incorrect to judge therefrom that the great mass of spawn floating about had not been produced by uncultivated oysters. The spawn of these latter may be stronger than that of the cultivated oyster; and I think I may admit that the quantity of spawn produced by an uncultivated oyster is larger than that produced by a cultivated one.

We see, therefore, that many so-called facts are only more or less weak probabilities, and that very few of these facts have been proved. The great value of earnest and accurate investigations would, especially in the beginning, not consist in proving many facts, but rather in pointing out the direction in which these investigations should be made. We have experienced sufficiently the truth of this in studying the mode of life and the physiology of that mysterious little animal, the oyster, and any one who has taken the trouble to gather some knowledge of the complicated processes of reproduction will not be surprised at this statement.

48.—NEW ENGLAND FISHERIES IN JUNE, 1885.

By W. A. WILCOX.

During the past month about all of the vessels following the fisheries have been engaged in their work, and a number of new vessels have been added to the fleets. The location of the fishing vessels at the end of the month was as follows:

316 sail, mackerel, scattered from No Man's Land, on the southwest, along the New England shore and George's Bank; 50 sail of the fleet off the Nova Scotia shore as far east as Canso.

133 sail, cod and halibut, on Grand Banks, longitude 49° to 54° 25′, latitude 43° 15′ to 46° 35′.

45 sail, cod and halibut, on Western Banks, longitude 59° 25′ to 62° 30′, latitude 42° 55′ to 44° 30′.

92 sail, cod and halibut, on Banquereau, longitude 57° 12′ to 60°, latitude 44° to 45°.

175 sail, cod and halibut, on Brown's and George's Banks, in longitude 65° 30′ to 69°, latitude 41° to 43°.

15 sail, codfish, off the Nova Scotia shore, in latitude 43° to 43° 25′, longitude 65°.

225 sail, ground fishing, off the eastern shore of New England.

11 sail, halibut, off the coast of Greenland and Iceland.

6 steamers, taking whales off the New England coast.

Total, 1,012 sail, 6 steamers.

The general result of the work of the month has not been satisfactory or profitable. Codfish have been abundant on George's and Brown's Banks, over half the total receipts of the month having been from there, mostly from the latter. During the latter part of the month, from want of good bait, the catch was much reduced. The catch of halibut on these banks has continued light.

On the Grand Banks fish have been reported scarce. On June 7 and 8 a severe gale badly damaged a number of vessels, sending them into St. John's, Newfoundland, for repairs, but no vessels or lives have been reported lost from the New England fleet. On the Western Banks codfish have been abundant and vessels arrived home with full fares. The shore fleet in Massachusetts Bay have had a fair catch; but almost continual fog has much interfered with the catch to the eastward, and vessels from there have come in with small fares. Mackerel, lately so abundant, have been found only in small lots of from two to five barrels, although vessels have constantly cruised for them from Block Island and George's Bank to the Bay of Fundy. Many vessels are returning from the month's work empty, and others come back with

small fares of mostly medium-sized fish. During the latter part of the month a small fleet secured good fares in Chedabucto Bay, Nova Scotia. The fish were mostly of good medium size, with a few large fish among them.

The first mackerel seen about Prince Edward Island this year were a few of small size and poor quality, taken by the island fishermen during the last week in June.

The close of this month ends the weir fishing for mackerel both on the Massachusetts and Nova Scotia shores. The catch by weirs has been very small in both sections, being the lightest for years at Sandy Point, Cape Cod. Mackerel in their migrations northward seem to have avoided their former usual route near shore.

Trap and net-fishing near shore have taken few fish of any kind, scarcely any squid. Herring have been seen in great numbers off shore, but only a small amount has been taken in traps. The scarcity of herring and other fish used for bait is particularly noticeable, being felt along the entire New England coast and also in the provinces, the only places that reported plenty of herring being the Magdalen Islands and Prince Edward Island.

The following are newspaper clippings in regard to Gloucester vessels:

ICELAND FISHING.—A letter from Isafiord, Iceland, says that the schooner Carrier Dove was the first vessel to arrive at the fishing grounds. She made the passage in twenty-three days from Liverpool, N. S. She left Gloucester April 15. The snow and ice cover the mountains, and the snow is 25 feet on a level. The harbor is entirely frozen over, and the entire coast is surrounded by heavy ice. Reports say it has been the hardest winter ever known in Iceland. The cattle all perished and the fish are reported scarce.—*June* 15, 1885.

GLOUCESTER VESSELS DAMAGED IN A STORM AT GRAND BANKS.—The recent storm at Grand Banks was one of the worst known for forty years, and many Gloucester vessels fishing there have sought the harbor on the coast of Newfoundland to repair damages and make good the losses sustained by the gale. Those already reported are as follows: At St. John's, the schooner Henry Wilson, Captain McKinney, was overtaken by the storm in latitude 44° 30′, longitude 51° 21′, and parted her cable, losing about 40 fathoms, with her anchor and all of her fishing trawls. She also sprung a leak, her bulwarks were stove, and everything movable, except her dories, was swept from her decks by the heavy seas, which made a clean breach over her, including about $100 worth of oil. She has been on the banks about eight weeks, and has about 1,200 quintals of fish. The crew are safe and well. Captain McKinney reports having spoken a Maine schooner which had lost five dories, and had her jibs blown away. The Elizabeth Foster, of Maine, was also spoken, and she reports having seen a schooner lying near her

during the storm, which suddenly disappeared, and, it is thought, foundered. The Henry Wilson, during her passage into St. John's, reports having passed through a quantity of wreckage, consisting of planks, dories, &c., and saw a St. Peter's vessel with her bow stove in and sails blown away. The Henry Wilson, while entering the harbor, struck on the rocks in the Narrows, where she remained fast for about two hours. She sustained but little damage, and has been docked for repairs. The schooner J. H. Higgins, Captain Stevens, of this port, from Flemish Cap, has also arrived at St. John's for repairs. The gale struck her while at anchor in latitude 46° 40′, longitude 45° 10′. She went adrift and lost all her fishing gear. Three of her dories were stove and her foresail was split. She left here April 6 and had 130,000 pounds of codfish and 6,000 of flitched halibut. The crew are all well. The schooners Spencer F. Baird and H. A. Duncan, both of this port, are at St. John's with loss of fishing gear, the former with loss of anchor and six hundred hooks, and had her jib-boom carried away, and the latter had her decks swept and foresail split. A number of Beverly vessels are at St. John's, more or less damaged by the gale, among them being the Sarah B. Putnam, Captain Larkin, and the D. A. Wilson, Captain Foster. The gale struck the former in latitude 45°, longitude 52°. Her bulwarks were stove and her decks swept, but fortunately without much loss. She sailed from Beverly April 14, and has about five hundred quintals of fish. The crew are all well. The D. A. Wilson had a narrow escape from colliding with a French bark, which broke adrift, and Captain Foster only saved the schooner from foundering by cutting her cable. She had her decks swept by a heavy sea and lost four dories and had her bulwarks badly stove. She will repair and refit and return to the Banks. A great deal of apprehension is felt by owners here for the remainder of the large fleet of fishermen from this port not yet heard from, but it is hoped that the above disasters will cover the losses; yet the large quantities of floats seen upon the Banks causes much anxiety for the rest of the fleet.—*June* 23, 1885.

Receipts of fish at Gloucester, Mass., June, 1885.

From—	Fares.	Codfish.	Halibut.	Pollock.	Hake.	Cusk.	Mackerel.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Barrels.*
Brown's Bank	152	4,469,000	73,900	.....	.....	.....	.....
George's Bank	70	1,297,000	78,500	.....	40,300	32,000	.....
Western Banks	19	1,351,000	52,000	.....	.....	.....	.....
New England Shore	45	709,700	4,300	109,000	73,500	71,500	.....
Grand Banks	30	100,000	923,300	.....	.....	.....	.....
N. S. Cape Shore	4	285,000	.....	.....	.....	.....	.....
Banquereau	2	30,000	65,000	.....	.....	.....	.....
Bay of Fundy	1	1,500	7,000	.....	.....	.....	.....
Mackerel trips	76	.....	.....	.....	.....	.....	6,626
Total	399	8,243,200	1,204,000	109,000	113,800	103,500	6,626

49.—PRESERVATION OF BAIT.*

By P. WAAGE.

A person engaged in the bank fisheries had requested the Danish Fishery Association to give him some directions for keeping herring and other small fish used as bait in a fresh condition for a considerable time. As the method recommended by Mr. Waage may be of general interest, and may induce some of our readers to try it on a large scale and as a business, we will here describe it briefly.

The problem may certainly be solved by filling a tin can with fresh herring and pure water, and by placing this can in a freezer until its entire contents are frozen solid. If such blocks of ice are put in ice they may be kept for years, and the herring in them will decay scarcely at all. When the air is cold enough, which however will rarely be the case, the use of the freezer becomes unnecessary.

Waage recommends that the tin cans should be square and not round, so that the blocks of ice with the herring in them can be packed closer, and that they should be narrower at the bottom and broader at the top, so that it may be easy to extract the block of ice. The block of ice will therefore get the shape of a blunt pyramid. To prevent the ice from melting it will be well to make the blocks of ice large; but, on the other hand, it will in many respects be more convenient for the fisherman to use smaller cans, as, when the block has begun to melt, the herring should be used as quickly as possible, because they will decay very soon. It is evident that the more fresh water is poured into the can in proportion to the quantity of herring, the longer will the block of ice keep and the herring remain fresh.

The freezing is done by mixing three parts snow, or ice ground fine, with one part common salt. It is important that both the salt and the ice should be crushed very fine. The salt should be cooled off beforehand. With the view to keeping this mixture as long as possible and to derive the greatest possible use therefrom, it should be made in an insulated vessel. This vessel should also beforehand be cooled off with ice or snow. When ice and salt, properly cooled and ground fine, are mixed in the above proportion, a liquid will be produced whose temperature may fall as low as 18 degrees below zero [centigrade?].

The quantity of this mixture needed for freezing a certain number of herring depends on the general temperature prevailing at the time, and to a great degree on the manner in which the work is done. It is, therefore, impossible to state exactly how much of this mixture is needed for a can of a certain size. As a general rule, the proper quan-

* "*Om Opbevaring af Agn for Fiskere.*" From *Fiskeritidende*, No. 49, Copenhagen, December 2, 1884. Translated from the Danish by HERMAN JACOBSON.

tity can be ascertained in the following manner: A common, solid fish-barrel is taken, whose height is supposed to be about 20 inches. This barrel is placed inside a large barrel or box, and the remaining space is filled with sawdust or closely-packed hay. After the fish-barrel has been well cooled off with snow or ice-water, there are put into it 50 pounds of finely-ground and cooled salt and 150 pounds of finely-crushed ice or snow. These two ingredients are well mixed, and in this mixture is placed the square tin can containing the herring and the fresh water. This tin can is about 22 inches high on every side, and its upper opening measures about 4 inches on every side. The whole is well covered with a lid and a piece of cloth or matting. The tin can holds about 20 *potter* (one *pot* equals 1.6 pints), and by experience one should ascertain in what proportion the herring and the fresh water should be filled in. No salt or salt brine should get into the tin can.

For several reasons it will be more profitable to freeze a large quantity of herring at a time than to freeze smaller quantities at frequent intervals. In the latter case it will be necessary to have several tin cans and as many insulated double barrels. These should then be used so as first to put the cans in the least cold barrels and gradually move them to the colder ones. As soon as the temperature of the mixture is at the freezing point it has lost its strength.

Such blocks of ice with bait frozen in them might be a remunerative article of trade, if we consider on the one hand the frequent complaints as to the scarcity of bait which we hear from time to time and from many different places; and if on the other hand we remember that just during the cold season when ice is very plentiful large quantities of herring are caught in many places. If artificial cold was used on a large scale, it would probably pay to use again the salt brine from the mixture, which will hardly be possible if the freezing is done on a small scale.

50.—THE FISH-CULTURAL ESTABLISHMENT OF LAKE SAINT-FRONT, HAUTE LOIRE, FRANCE.

By Viscount DE CAUSANS.

[Abstract.*]

This establishment, founded in 1852, has an altitude of 4,100 feet; while the lake, on which it is situated, has an area of about 86 acres; 20,000 fry, on the average, are yearly put into the lake. In 1852 the establishment did not pay expenses; but since 1860 the sale of trout has never been less than $570, and it has sometimes reached $1,500. Since 1880 the establishment has put into the lake an average of 100,000 fry hatched on the spot.

* *Bulletin de la Société d'Acclimatation*, March, 1885, p. 148.

Two copious springs, recognized after many experiments as most favorable for hatching trout eggs, now furnish all the apparatus for fish-culture. The room used for hatching is about 56 feet long and 13 wide. All around this are arranged in shelves cemented troughs, from 2 to 3½ feet wide. A lodging for the janitor extends from the building.

Some indispensable covered reservoirs, with an area of about 65 square yards, communicate with the hatching room. In front of this building there has been dug a basin, with an area of 144 square yards, divided into four compartments. The level of the water is regulated from the inside. The different compartments are filled or emptied separately with great rapidity, so as to capture easily the spawning fish. Being fed from abundant springs, this basin never freezes. A boundary-wall adjoining the buildings shelters it from all danger. All these reservoirs are intended to receive trout at spawning time.

Taking trout for market begins about April 1, and ends about October 1; and about October 15 they begin to collect the eggs. At this time the fish are taken either by the aid of ditches, spoken of by Raveret-Wattel in a report on foreign fish-culture,* or with nets. In 1882, from October 20 to November 15, there were taken 500 trout, one-fourth of them females, which yielded 120,000 impregnated eggs. In 1883, during the same time, 1,500 trout were taken, one-third females, and 330,000 eggs were obtained. Of these 1,500 fish, 112 died in consequence of the extraction of the eggs or from hurts received from the nets, the rest being put back in the lake. From these figures we can judge of the number of trout necessary in order to obtain a large number of eggs. Notice here that many females are either infertile or seem not to spawn every year. It seems also that trout raised in captivity are too often infertile or slow in breeding.

Do not these considerations support this opinion, that a great fish-cultural establishment can exist only on the border of a lake? Such establishments can succeed everywhere where there are trout and spring water; but so far as the reservoirs are only small bodies of water or basins, they will produce only limited numbers of eggs.

In 1884 they hope to obtain 1,000,000 eggs at Saint-Front. The grounds, reservoirs, nets, &c., are sufficient for this; 100,000 eggs will be kept for the lake; the other 900,000 will be sold. There is no trouble here about getting trout enough from which to obtain the eggs. On November 20, 1883, the fishing of a single morning gave 118 trout, weighing about 100 pounds. The supply of the eggs will then be limited only by the demand. It will be sufficient to begin fishing for these eggs some days earlier, or at the time of the last forwarding of trout to the provision dealers, to save out the females and place them in the basins at the time of spawning. The establishment will then be able to respond fully and satisfactorily to all the demands for eggs which may be made upon it.

Bulletin de la Société d'Acclimatation, November, 1883, p. 638.

51.—NOTES ON THE FISHERIES OF GLOUCESTER, MASS.

By S. J. MARTIN.

[From letters to Prof. S. F. Baird.]

SUMMARY.—I give below the amount of fish landed at Gloucester during the month of December, 1884: Codfish from George's Banks, 846,000 pounds; halibut from George's Banks, 9,550 pounds; and fresh halibut from the Banks, 345,000 pounds. Fish caught in cod gill-nets and landed at Gloucester: Codfish, 653,000 pounds; and 267,000 pounds of pollock. There were also landed 144 barrels of mackerel from the Bay of Saint Lawrence; 183,000 frozen herring, caught at Monhegan, and 500 quintals of dried hake, by freight from Maine.

COD GILL-NETS.—There were caught in gill-nets and landed at Rockport during December, 325,000 pounds of codfish and 10,000 pounds of pollock. There were also caught in gill-nets and landed at Lynn in December, 210,000 pounds of codfish and 16,000 pounds of pollock. lock. There are 7 vessels using cod gill-nets that have gone east as far as Matinicus. I think 50 vessels are too many for Ipswich Bay, and it is well that some of them seek fish on other grounds.

HERRING.—The schooner Cecil H. Low arrived from Newfoundland yesterday morning with 375,000 frozen herring, having been gone from home thirty-five days. This is the earliest date at which a cargo of frozen herring has been brought from Newfoundland. The schooner reports herring plentiful and the weather mild. More vessels are daily expected from Newfoundland.

GLOUCESTER, MASS., *January* 4, 1885.

COD AND HERRING.—Vessels using cod gill-nets find fish very scarce, and though they carry 24 nets, do not average more than 2,000 pounds. The past week there have been two cargoes of frozen herring from Newfoundland and one cargo from Grand Manan. There are 2 more vessels on their way home from Grand Manan with frozen herring, and 5 vessels with cargoes of frozen herring from Newfoundland. Herring sold to-day at $1.25 per hundred.

VESSELS.—Eight vessels sailed to-day for George's Banks, making a total of 15 thus far. There are 23 vessels after fresh halibut, 28 at Newfoundland after frozen herring, 6 vessels at Grand Manan for frozen herring, and 41 vessels using cod gill-nets in Ipswich Bay. All the vessels which fish on George's Banks will be ready to sail the 1st of February. Some of the southern mackerel-catchers will start the 1st of March.

GLOUCESTER, MASS., *January* 14, 1885.

THE FLEET.—The weather has been extremely cold and windy. The schooner Virginia Dare arrived from the banks with frozen herring; most of the crew were frost-bitten. The schooner Henry Longfellow has also arrived from George's Banks, with 10 of the men frost-bitten. Vessels from George's Banks bring good fares. Thirty of the fleet sailed for those banks last week, and as many more will sail this next week. Of the 25 vessels which go for fresh halibut, all are out but 1.

Some of the mackerel fleet will start for the south about March 1, while some even talk of starting February 20.

There are 4 vessels on their way home from Newfoundland, and 10 vessels from Grand Manan, with full cargoes of frozen herring. Five vessels have left this port for Grand Manan for frozen herring; and it is expected that in a week's time there will be plenty of these fish. Codfish will be coming in quite freely within ten days.

COD GILL-NETS.—The vessels using cod gill-nets met with better success last week than the week previous. At Rockport 40 boats landed 162,000 pounds of codfish, which brought a large price. The average price during the week was 3¼ cents a pound.

GLOUCESTER, MASS., *January* 25, 1885.

SUMMARY.—During the month of January there have been 12 arrivals from George's Banks, landing 330,000 pounds of salt cod and 31,600 pounds of frest halibut; 6 arrivals from the Banks with 14,300 pounds of fresh halibut; 5 arrivals from Grand Manan with 1,120,000 frozen herring; 2 arrivals from Newfoundland with 775,000 herring; 1 arrival from Eastport with 4,000 boxes of smoked herring; also 19,000 pounds of codfish and 70,000 pounds of haddock caught in nets.

COD GILL-NETS.—There have been landed at Rockport 455,000 pounds of fish; at Portsmouth, 155,000 pounds of fish; and at Lynn 62,000 pounds of fish; all being caught in nets.

Some of the vessels using trawls in Ipswich Bay have done better than the netters. The fish caught on the trawls are mostly males, but not so large as the fish that are taken in the nets, which are mostly females of large size.

GLOUCESTER, MASS., *February* 1, 1885.

SUMMARY.—The George's Banks fleet has not done well, 5 arrivals having landed only 136,000 pounds of codfish and 10,000 pounds of halibut. There have been 9 arrivals from the Banks, 4 landing 62,000 pounds of halibut, and the remaining 5 bringing 84,000 pounds of haddock. The arrivals from Grand Manan were 4, with 970,000 frozen herring.

BAD WEATHER.—For the last twenty-one days the weather has been cold and windy, and during the past week the ice in the harbors has been a foot thick. Vessels at Newfoundland will have a difficult time in reaching home. A telegram from Capt. Charles Martin, of the schooner Mystery, at Saint Pierre, Newfoundland, states that he has been waiting with a load of frozen herring since January 21. The

schooner Henry W. Wood, also remaining at Saint Pierre, Newfoundland, on January 28 stated that the weather was very cold, a gale of wind having been blowing from the northwest for six days, and that the gulf is full of drift ice. Two vessels which were bound for home returned to Saint Pierre, Newfoundland, this afternoon, having been out five days. Three vessels from Grand Manan, which have been frozen up for fourteen days in the harbors on the Maine coast, have arrived with cargoes of frozen herring. There are still 6 vessels on the Nova Scotia shore. Eleven Gloucester fishermen have been disabled.

COD GILL-NETS.—Vessels using cod gill-nets meet with little success, and 10 vessels which have been fishing with them in the harbor are frozen in the ice. There are 38 vessels fishing cod gill-nets in Ipswich Bay. During the past week there have been landed by cod gill-nets at Portsmouth, 80,000 pounds of codfish; at Rockport, 70,000 pounds of codfish; and at Gloucester, 10,000 pounds of codfish. The price of the fish has been 3½ cents a pound during the week.

GLOUCESTER, MASS., *February* 8, 1885.

SUMMARY.—During the past week there have been 18 arrivals from George's Banks, 14 landing 275,000 pounds of codfish and 21,000 pounds of halibut, and 4 landing 118,000 pounds of haddock; 4 arrivals from the Banks with 36,800 pounds of fresh halibut; 5 arrivals from Grand Manan with 1,540,000 frozen herring, and 1 arrival from Newfoundland with 600,000 frozen herring.

HADDOCK.—Haddock are very plenty on George's Banks, 1 vessel, with 6 dories and 1,000 hooks to the dory, having caught 50,000 pounds in one day. The haddock are two-thirds females and are full of spawn. The weather for the three weeks has been quite rough, but the codfish on George's Banks have been abundant. The George's vessels which arrived to-day landed from 40,000 to 50,000 pounds, being gone fourteen days.

HERRING.—There have been 3 arrivals to-day from Newfoundland with cargoes of frozen herring, and 3 vessels have already sailed from Grand Manan for this port with full cargoes of frozen herring. Herring are selling at 70 cents a hundred. Half-size herring are quite numerous in Ipswich Bay.

There are 20 sail in Ipswich Bay using trawls; they are doing better than the netters, fishing 4 miles outside of the nets.

COD GILL-NETS.—Notwithstanding the fact that the weather during the past week has been cold and windy, the vessels using cod gill-nets have done well, having landed at Portsmouth 170,000 pounds of large codfish; at Rockport 48,000 pounds of codfish; and at Gloucester 10,000 pounds of codfish. The fish sold for a high price, the average during the week being 4 cents a pound.

The harbor still remains full of ice, and vessels can get in no further than Harbor Cove.

GLOUCESTER, MASS., *February* 15, 1885.

SUMMARY.—During the past week there were 18 arrivals from George's Banks, 15 of which landed 359,000 pounds of codfish and 43,000 pounds of halibut, and the 3 others, 86,000 pounds of haddock; 7 arrivals from Newfoundland, with 305,000 frozen herring; and 5 arrivals from Grand Manan, with 1,774,000 frozen herring.

BAD WEATHER.—The weather has been very rough, and all the vessels which arrive are more or less damaged. The gale of the 15th instant was very heavy on George's Banks, and I fear that great damage has been done on the Grand Banks. A vessel which sailed from this port on January 1, for halibut, has not returned yet, while a number more have been out a long while. The harbor still remains full of ice.

COD GILL-NETS.—The 30 vessels which have been using cod gill-nets in Ipswich Bay lost most of their nets last Monday in a heavy gale of wind. There were, however, 12 vessels in this port with nets on board. During the past week there were caught in gill-nets and landed at Portsmouth 60,000 pounds of codfish; at Rockport, 40,000 pounds of codfish; and at Gloucester, 10,000 pounds of codfish.

GLOUCESTER, MASS., *February* 22, 1885.

COD GILL-NETS.—The amount of codfish caught in cod gill nets during the month of February, 1885, was as follows: 160,000 pounds landed at Rockport, 150,000 pounds at Portsmouth, and 46,000 pounds at Gloucester. Vessels using cod gill-nets did not do well during the past week. The codfish suddenly left Ipswich Bay on the night of February 24. The fishermen, however, think they will return, as this is not the first time they have all left this bay in one night.

GEORGE'S BANKS.—The codfish are abundant in some places on George's Banks. In two days the schooner Rapid Transit caught 45,000 pounds of codfish on haddock trawls. The schooner Oresa, which carries 8 dories, caught 14,000 pounds of codfish and 90,000 pounds of haddock in three days. Haddock are also plenty on George's Banks, and vessels carrying 6 dories catch from 50,000 to 100,000 pounds in two days. There were 2,000,000 pounds of haddock landed in Boston on Thursday, Friday, and Saturday. The halibut catchers have not done well, some of them who have been absent seven weeks bringing home only from 15,000 to 20,000 pounds. Most of the vessels went to the Grand Banks, where they experienced rough weather, and found halibut scarce.

GLOUCESTER, MASS., *March* 1, 1885.

MONTHLY SUMMARY.—The following is the summary of the fish landed at Gloucester during the month of February, 1885:

Sixty arrivals from George's Banks, 44 of which landed 898,000 pounds of codfish and 104,000 pounds of halibut, and the remaining 16 327,000 pounds of fresh haddock; 13 arrivals from the Banks, with 189,800 pounds of fresh halibut; 2 arrivals from Le Have Bank with 55,000 pounds of codfish and 14,000 pounds of halibut; 17 arrivals from

Newfoundland with 5,715,000 frozen herring; 10 arrivals from Grand Manan with 4,017,000 frozen herring. There were brought from Maine 16,000 boxes of smoked herring and 50 barrels of salted herring.

GLOUCESTER, MASS., *March* 1, 1885.

SUMMARY.—During the past week there were 19 arrivals from George's Banks, 18 of which landed 2,768,000 pounds of codfish and 30,600 pounds of fresh halibut, the remaining one landed 50,000 pounds of haddock; 5 arrivals from the Banks with 68,000 pounds of fresh halibut; 5 arrivals from Newfoundland with 1,840,000 frozen herring; and 1 arrival from Grand Manan landed 280,000 frozen herring.

HADDOCK.—There are 63 vessels engaged in the haddock fishery, and they have done well during the past twelve days. There are 25 vessels in Boston to-day with average cargoes of 35,000 pounds of fresh fish—half codfish and half haddock—caught on George's Banks. When the haddock catchers baited their trawls with salted porgy slivers ten years ago, they very seldom caught any codfish; on the contrary, since frozen herring have been used for bait, as many codfish as haddock are taken on the trawls. It is easily seen that the fares of the vessels using hand-lines are small in comparison with those of the vessels using trawls, and also the annoyance which the former suffers from the latter, when it is known that as soon as a haddock catcher sees a vessel at anchor fishing for codfish with hand-lines, it will set its trawls completely around the vessel, knowing that a good bottom for codfish is a good bottom for haddock. The haddock catchers carry 6 dories, with 1,000 hooks to the dory, a total of 6,000 hooks; while the 12 men on the vessel using hand-lines fish 12 lines with 2 hooks to the line, a total of 24 hooks. Hence the haddock catchers take the fish. One vessel is now in port with 40,000 pounds of codfish and 20,000 pounds of haddock, the result of two days' fishing with trawls. The day is near at hand when the cod fishermen will use trawls on George's Banks.

COD GILL-NETS.—There were caught in cod gill-nets and landed at Gloucester during the past week 26,000 pounds of codfish. When the codfish left Ipswich Bay all the boats took up their nets, but some of them fitted out trawls, as the boats using trawls were catching a few fish. Captain McCloud went to Ipswich Bay March 3 and took 24,000 pounds of codfish from 24 nets which had been set only two nights. At present there are 10 boats fishing nets in the bay, and they have all done well since last Tuesday, catching more fish in the nets than with the trawls. The cod sold at 1½ cents per pound all the week.

WHALES.—The fishermen say they have never seen whales so numerous on the eastern shore as at present. The steamer Fannie Sprague, of Booth Bay, formerly used in the porgy fishery, which has been fitted out as a whaler, shot six whales last week. Two of them were safely towed to Booth Bay, but the other four, which sunk, are buoyed.

GLOUCESTER, MASS., *March* 8, 1885.

SUMMARY.—The following are the arrivals at this port during the past week: Forty from George's Banks, 39 with 2,099,000 pounds of codfish and 34,600 pounds of halibut, and 1 with 10,000 pounds of haddock; 7 from the Banks with 250,000 pounds of fresh halibut; 1 from Le Have Banks with 10,000 pounds of codfish and 24,000 pounds of fresh halibut; 12 from Ipswich Bay, landing 55,000 pounds of shore codfish caught on trawls; 9 from Grand Manan, with 2,810,000 frozen herring; and 2 arrivals from Fortune Bay, Newfoundland, with 570 frozen herring. There were also received 750 quintals of dried mixed fish by freight from Maine, and 10,000 boxes of smoked herring from Eastport.

GEORGE'S BANKS.—There has been a large school of codfish and haddock on George's Banks, and all the vessels have brought in good fares of both kinds of fish. The halibut catchers did well the last trip, and four fares are being discharged in the harbor at 5 cents a pound by the cargo.

PRICE.—The price of fresh fish is low. Codfish sells for 1¼ cents a pound; fresh haddock at 80 cents a hundred pounds. Large codfish, caught in nets last night, sold for 1¼ cents a pound. Salt fish sell at better figures; salt fish green from the vessel bring 2½ cents a pound, newly dried George's codfish bring $4.75 a quintal.

COD GILL-NETS.—Vessels using cod gill-nets still do well. There were 245,000 pounds of codfish caught in nets last week and landed at Rockport and Portsmouth. The schooner Blue Jay landed 16,000 pounds of codfish at Rockport last night, the result of three nights' fishing. The other boats have done equally well.

GLOUCESTER, MASS., *March* 15, 1885.

COD GILL-NETS.—There is a large school of codfish in Ipswich Bay, and a good many are being taken with cod gill-nets. Three weeks ago most of the fish were taken on trawls, but now the trawls have been put ashore and nets are principally used. The cod of the first school that came into the bay this winter were small, averaging 18 pounds each, and were mostly males. The fish now caught average 39 pounds as they come out of the water. I weighed 4 large fish yesteday amounting to 224 pounds. They were mostly females and full of spawn. In two nights last week 3 vessels caught 20,000.

BANK ARRIVALS.—There were 25 arrivals from George's Banks last week, with average fares of 15,000 pounds each. The haddock catchers landed 101,000 pounds of codfish last week. The 4 halibut catchers that arrived last week averaged 30,000 pounds each. All these were from the Grand Banks.

PRICES.—Fresh halibut sold by the cargo at 5 cents per pound, codfish at 2 cents per pound, and haddock at 1½ cents per pound. The large cod caught in nets sold at 2½ cents per pound for steak.

There have 32 vessels gone south for mackerel.

GLOUCESTER, MASS., *March* 22, 1885.

Vol. V, No. 14. Washington, D. C. Aug. 7, 1885.

52.—NOTES ON CARP AND FROG CULTURE.

By JOHN H. BRAKELEY.

Two excellent plants for a spawning pond are the azolla and the water-chestnut.

THE AZOLLA.—This is a small cryptogam, with minutely imbricated leaves, and fibrous roots freely floating in the water. These little plants multiply rapidly, and early in the season will cover closely, as with a beautifully variegated carpet, considerable portions of the pond near its margin. They thus become suitable hiding-places for the different varieties of protozoans, where the latter find partial protection and have a chance to multiply. Later in the season I have frequently noticed the young carp working among the floating roots, evidently in pursuit of food. Besides their furnishing excellent pasture grounds for the young fish, they are decidedly ornamental. When growing in the shade their color is a rich green of various tints, while where they receive the full sunlight they are a beautiful purple.

THE WATER-CHESTNUT (*Trapa natans*).—This is also a floating plant, but with much longer roots than the azolla, so that it does not move about readily in the water. It is a phenogamous plant, but with an inconspicuous flower, its beauty consisting in its foliage. Though a native of India, where it is said to be largely cultivated for the nuts which it produces and which are used for food, it grows well in the ponds of our Middle States. The leaves are of rich deep green, with scalloped edges, floating in the water and forming a compact mass some 10 or 12 inches in diameter. It can be grown among other water-plants with very fine effect. It does well in water from 1½ to 2 feet in depth, sending its fibrous roots nearly or quite to the bottom. The nuts, about the size of an ordinary chestnut, are formed beneath the leaves, and when not gathered fall to the bottom of the pond. There they remain till the following spring, when, in due time, the delicate, graceful leaves make their appearance above the water. The fibrous roots doubtless furnish an abundance of shelter, where water animalcules may hide and multiply, which they do with immense rapidity under favorable circumstances. In a pond warmly located and supplied with only enough water to make up the loss from evaporation the multiplication of these little denizens of the water is simply wonderful. It is said that one female cyclops will be the parent of over 4,000,000,000 in a single year. While many of these small creatures are eaten by the carp, others become the prey of the larger water larvæ, which eventually also become

the food of the carp. It is well then to encourage in our fish ponds the growth of plants with fibrous roots, like those named above, which, as indicated, will greatly increase their capacity for supplying food to the fish.

ARTIFICIAL FEEDING OF CARP.—Carp culture in this country has ceased to be an experiment. While many who received the stock allotted to each by the Fish Commission, through ignorance or neglect, failed to turn them to account, many others have entered upon the care of the fish with enthusiasm, and in their hands the result has been most satisfactory. While much is yet to be learned, sufficient is already known to assure us of the fact that food carp can be raised in private ponds with profit. In regard to them we can speak more confidently than we can of any other fish the cultivation of which has been attempted in modern times. Give them a warmly-located pond with muddy bottom, well supplied with aquatic plants, and free from all other fish, and from the common small reptiles, protecting them from kingfishers, fish-hawks, and bitterns; before they are thirty months old they will furnish you with an ample supply of delicious boiling fish, averaging at least 4 pounds in weight. This they will do with little or no artificial feeding. Then if you will arrange a suitable spawning pond, stocked with a few adult fish; and a growing pond, stocked with young fish, at the rate of 1,000 to the acre; with your market pond twice as large, so that when the growing fish are transferred to it at the beginning of their third summer, there will be 500 fish to the acre; you will have an establishment which will require some care, it is true, but which will make you ample returns in the shape of an annual supply of about 2,000 pounds of fish to the acre.

But results far beyond this may be secured by artificial feeding. Possessing, as they do, excellent digestive organs, few animals respond as readily to an abundant supply of food as do carp. Of this I have abundant proof. Take the following illustration: In a spawning pond, in which I had placed 12 adult fish, at the beginning of their third summer, one of them at least spawned during the season, as in the autumn in drawing the pond I found 15 young fish—all that had escaped the numerous enemies with which the pond abounded. Having ample room and an abundance of food, they had grown rapidly, attaining a length of from 7 to 10½ inches, and an average weight of 10½ ounces. Having so good a start for their second summer, at its close last October their average weight was 2⅖ pounds. This they did, too, with 2,145 young carp in the three quarter acre pond with them. This is about 1 pound more than the average weight of their parents at the same age. Doubtless they would have been much larger at the close of their second summer had not the food resources of the pond been drawn upon by the large number of young fish which occupied it with them.

What their growth will be during the third summer is yet to be determined. During the corresponding period in the life of their parents,

they increased from an average weight of $1\frac{7}{16}$ pounds to $4\frac{1}{2}$ pounds—an increase of fully 300 per cent. Should these young fish make a proportionate increase during the next summer, they will attain a weight of 7 pounds. They may fall short of this, but having an extra pound to begin with, they will doubtless be very fine fish next autumn.

Other illustrations could be given, pointing in the same direction. From all which we conclude that if all the food carp will consume be given them their growth will be simply astonishing.

In regard to the economy of feeding carp artificially, the matter has been carefully tested in Germany. It has been determined, as we are assured on the best authority, that 1 pound of food containing a suitable proportion of albumen and the carbo-hydrates, and costing about 4 cents of our money, will produce an increase of 1 pound of fish flesh. As the food used is quite as cheap if not cheaper here than across the water, a similar result can doubtless be produced in this country, and with a very large profit.

FROGS EATING YOUNG CARP.—Frogs have a reputation for possessing a fondness for young carp. The dissection of a considerable number last summer satisfied me that this is no slander, and that small fish, including carp, enter largely into their bill of fare; hence they have no more business in a carp pond than have eels and water-snakes. Not only does the bull-frog (*Rana pipiens*), but also the smaller green frogs (*R. esculenta*) delight in a fish diet. One of the latter I caught in the act of trying to swallow a carp nearly as large as itself. By an expert dodge it escaped a blow of my cane, and left the carp dead, which measured 4 inches in length. On another occasion, while transferring the young carp to the growing pond, another green frog was seen to capture one, and, swimming away to a neighboring tussock, swallow it at its leisure.

Of the 12 bull-frogs dissected, one had in its capacious maw 4 brown mud-fish, the largest being 3 inches long. One only of the 12 had recently made a meal on carp, but had taken 2 to satisfy its appetite. These large frogs had drawn upon every department of animated nature for their supplies of food, including a full-grown meadow mouse, 1 young bird, 1 frog, 2 toads, 2 carp, 6 mud-fish, 1 mud-turtle, 1 potato-beetle, 2 curculios, 7 other land-beetles, 1 dragon-fly larva, 1 other water-larva, 2 bugs, and 2 green caterpillars. They are said also to eat the eggs of the carp. This is probably true of the smaller frogs, but the full-grown bull-frog, as well as the edible frog, seems to prefer larger game.

DO SNAPPING-TURTLES EAT CARP?—Snapping-turtles are said to be very destructive to carp—indeed one of their worst enemies. And this may be true as far as the small carp are concerned. As bottom feeders they would readily come within the reach of these vicious reptiles, who would only have to hide themselves in the mud and wait for the unsuspecting prey to come within the reach of their vise-like jaws.

But I have some evidence—though it is true only of a negative character—which would seem to indicate that they do not feed on carp of any considerable size; and as even this ill-favored, ill-tempered reptile is entitled to its due, I will give it. At the close of the summer of 1882 I placed my carp, then 40 in number, in my ponds, they having attained an average length of 13 inches and an average weight of 1 pound and 7 ounces. Knowing that snappers abounded, I gave special attention to their destruction, and during the summer following captured 40 of them, varying in weight from 3 to 10 pounds; and yet when the water was withdrawn in October, all the carp were there save one, which a fish-hawk was seen to capture. At the close of last summer, though many snappers had escaped the warfare made upon them during the previous season and continued the past summer, not one fish was missing. How many young carp they may have eaten, of course, I have no means of determining—enough doubtless to satisfy their hunger, but they evidently had no taste for large fish.

It is not so difficult to capture snapping-turtles as is generally supposed. Though the muscles which control the movement of the jaws are of great strength, yet since the cutting edges do not exactly correspond, they cannot bite in two an ordinary piece of twine. I have known one weighing 30 pounds to be caught on a piece of twine no larger than a stout fish line. Ordinarily strong twine, with regular snapper hooks attached, will hold them, care being taken not to let the bait (a piece of salted eel being the best) come so near the bottom that they can reach it when hooked with all four feet. If they can do this a large one will be likely to straighten out the hook or to break the line holding it. Besides this method of capturing them there are others quite as effective.

There being a considerable demand for them in market, they might be raised with profit were it not from the fact of their very slow growth. The female lays her eggs in the sand, with only a light covering over them, and as skunks are fond of them and make careful search for them, where this animal abounds snappers are not likely to multiply very rapidly.

RAISING FROGS FOR TABLE USE.—To those who have tried them, frogs' legs, when properly cooked, are a great delicacy; and, judging from our market reports, the demand is quite up to the supply. Can they be successfully cultivated as an article of food as other animals are cultivated, and, if so, will it pay? Some years ago I thought of establishing a froggery, and wrote to persons whom I supposed most likely to be posted on the subject, but could hear of no one who had had experience in this kind of culture. The great difficulty seemed to be to know what to feed them. With the tadpoles there was no trouble, as they are vegetable feeders, and abound in our carp ponds. Last spring I took 2½ bushels from one of my ponds, they having gone safely through the winter; and in the fall took from the same pond five times as many. It seemed a great pity that there was no better use for them

than to turn them into guano. After their transition into froghood, they are no longer satisfied with a vegetable diet. But as they draw their supply of food from all departments of animated nature, it ought not to be difficult to supply their wants. At times their special food is abundant and easily obtained. Potato-beetles enter largely into their bill of fare, as do also caterpillars and curculios. All these are abundant at times, and an ample supply is usually attainable for a considerable portion of the summer. Brown mud-fish, too, is a favorite, which can often be obtained in large quantities in the ditches. True, they do not hesitate, occasionally, to make a meal on a fellow frog, but in the great multitude that could be readily raised, these would scarcely be missed. If they should require their food to be alive when they take it, there might be some difficulty in supplying their wants. But if they feed on the eggs of the carp, as they are said to do, I can see no reason why an artificial food could not be provided for them. Ground dried blood, or ground fish-scraps, mixed with boiled potatoes, might be put in such shape that they would feed upon it. The experiment could easily be tried by any one wishing to test it. An inclosure of a few square yards of water with a small space of dry land, having a base of boards rising 2 or 3 inches above the water, and surmounted by a fence of $\frac{1}{4}$-inch mesh of galvanized wire 2 feet high, would make a very respectable froggery. If one did not care to raise them for market, a supply for home use would be no mean addition to one's larder.

BORDENTOWN, N. J., *December* 26, 1884.

MARKETING CARP.—Carp will probably make their appearance in the markets of our large Eastern cities next autumn in considerable quantities. The very large number distributed by the Fish Commission, being the hatch of 1881, spawned sparingly in the latitude of the Middle States in 1883. Next autumn these fish will be three summers old, the age at which they may be more advantageously marketed, where raised for profit. In some instances these will doubtless bring fancy prices. According to a newspaper report, a few sold last summer in Fulton Market, New York, at 30 cents per pound—fish said to have been caught in the Potomac River, having got there from the national carp ponds at Washington, D. C., during a heavy freshet. But whatever prices they may bring when they first make their appearance in market, they will ultimately settle down to a price which will be determined by their quality as food. Hence it is an important matter for those who are engaged in their culture that their edible qualities should be such that they will make a favorable impression on the public. As these qualities are to a considerable extent under the control of the culturist, I propose offering a few suggestions in regard to the best mode of preparing them for market.

(1) Always kill your fish as soon as taken from the water. This is much more important and has much greater influence on their edible qualities than is generally supposed. Having always found the pike

and catfish which I get at my country home much superior to those which I purchase in our city market, I have been accustomed to attribute this difference to something peculiar to the water of our antiseptic peat bottoms; but now I conclude that it is due rather to the fact that those in the country are killed as soon as caught, while those of our market are permitted to die a lingering death. In preparing poultry for the table, it would be quite as rational to hold the chicken's head under water till it ceased to breathe as to permit a fish to struggle in the air till dead. And as carp have great vitality this struggle will be kept up for a long time. The killing can readily be done by thrusting the long blade of a pocket knife under the edge of the gill-cover down through the fish, so as to sever the main artery. It will then bleed freely and die speedily, and leave no unsightly wound.

(2) Never take fish directly to market from a pond in which the bottom is strewed with decaying leaves. A market pond should be so situated that the leaves of deciduous trees will not blow into it, since they uniformly impart an unpleasant flavor to fish feeding on or among them. Carp have already suffered in reputation because of a neglect of this precaution. A part, at least, of the very few who have pronounced them an inferior fish have eaten them directly from ponds the bottoms of which were covered with leaves in a state of decomposition. If your market pond is so situated that leaves cannot be kept out it will pay to have large tanks constructed in which to keep them a couple of weeks before offering them for sale, or, better still, have live-boats built, with wire bottoms, and confine them in these, anchored in running water, a week or two before you wish to market them.

(3) Do not market your fish in summer. For the seven months beginning with October they are in season in the latitude of the Middle States. During the months of May, June, and July they are engaged in spawning, and are not fit to be eaten, and, besides, are not in proper condition for the table till some time after the spawning season is over. For home use a supply of those two years old may be kept in a small pond; and if this is supplied with spring water they will be found a fine table fish during any of the summer months; but the disposition of the general crop should be confined to the fall, winter, and early spring months.

Carp start off with a fine reputation as an excellent table fish. Not in Europe alone are they highly esteemed, but of the two hundred and forty persons in this country who gave their estimate to the U. S. Fish Commission of their qualities as a table fish, nearly all spoke of them in the highest terms. With care on the part of the culturists this reputation can be maintained and good prices secured.

ORDINARY GROWTH OF CARP.—Some very remarkable instances of the growth of food carp have been reported. Where a few fish have been placed in a pond warmly located, well stocked with aquatic plants, and where water insects abound as they usually do in such localities, their growth

has seemed wonderful, and yet it is probably not more so than is that of a pig of good breed, supplied with all the food of the best quality that it can digest and assimilate. In this particular of being able to consume large quantities of food and make a corresponding growth, carp seem to resemble this greedy animal more closely than any other with which we are familiar. What they will do at their very best is a question of much interest, yet of much less practical importance than to ascertain what growth they will make under ordinary circumstances; that is, placed in a suitable pond, and left to take care of themselves.

Careful inquiry in regard to a considerable number of the fish distributed by the Commission during the season of 1881 in the latitude of Middle New Jersey has led me to the conclusion that at the close of their third summer, or in the autumn of 1883, they had attained an average weight of 4½ pounds.

In order to determine how nearly the growth of carp under an ordinary system of culture will compare with that of these particular fish, two facts must be taken into consideration. It must be remembered that the young fish distributed by the Commission were very small—much smaller indeed than fish of the same age bred under ordinarily favorable circumstances. Our national breeding ponds at Washington were taxed to their utmost to supply the wants of the thousands of applicants for young carp; and though of comparatively limited capacity, under the skilful management of Dr. Hessel, who has the special care of them, were made to yield 160,000 young fish for distribution; of necessity, therefore, they were small. While under ordinary culture young fish will during their first summer reach a length of from 3 to 4 inches, and frequently much larger, many of those distributed were only 2 inches long. It is obvious, therefore, that at the close of their third summer they would not have attained the size they would have done had they had a better start. No animal stunted while young will ever entirely recover, no matter how favorable the circumstances under which it may be afterwards placed.

And this brings us to the other fact referred to, namely, that many of these young fish were more favorably situated for rapid growth than young fish usually are in a well-established system of carp culture. One thousand fish to an acre of water for their second year, and half as many for their third year, is said to be a suitable number for ordinary ponds. But in providing for the fish received from the Commission in many instances comparatively large ponds had been prepared, so that the 20 little fellows found themselves the sole occupants of acres of water with abundance of food scattered everywhere around them, so they had opportunities for growth such as do not ordinarily fall to the lot of young carp.

The two facts named may be considered as about balancing each other, and the conclusion is reached that 4½ pounds is the normal weight they may be expected to attain in this latitude, at the close of their third

summer, the time when those raised for market will be ready for the table.

If further observation shows that this rate of stocking ponds is the correct one, as I think it will, it is not difficult for the carp culturists to calculate what returns he may reasonably expect from each acre of his market ponds. Five hundred fish, each weighing 4½ pounds, allowing a little over 10 per cent for loss, will make him 2,000 pounds to the acre. The price he will receive for them will depend upon their quality, in connection with his skill in marketing them; and their quality will depend much upon the manner in which they are prepared for market.

BORDENTOWN, N. J., *January* 28, 1885.

53.—TIME OF APPROACH OF FISH TO THE NEW ENGLAND COAST.

By N. E. GOULD.

The following is a statement of the several kinds of fish coming on our coast (the southeastern part of Massachusetts). The first fish that visit our coast are the alewife herring, which usually appear about the 15th of April. The present year the fish were seen on the 20th of that month. The alewife herring never school or appear on top of the water in large numbers in this vicinity, although large numbers of them are taken annually.

The next that come are the shad, which vary but little from the middle of April. The first caught the present season was on the 23d of the month. These, like the alewives, never school or seem to come to the surface of the water, but are caught during the month of May in considerable numbers.

The herring come about the 10th of May. This year the first caught here was on the 11th of the month. These are always seen in large numbers schooling at the surface of the water, and are seldom caught unless they are so seen. The first schools seen the present year were on the 11th of May.

The first mackerel put in an appearance on May 2, and the first schools on May 22.

The first bluefish came on the 27th of May, but no school until June 16, and these very small.

The first menhaden were caught on May 14, but no schools were seen during the season, although these fish were at a former time very numerous on this coast during the month of May. None have been seen schooling in large schools since the spring of 1875. Before that time they were probably the most numerous fish that passed along this coast.

UNITED STATES LIFE-SAVING STATION,
Chatham, Mass., June 20, 1885.

54.—NOTES UPON THE SCOTCH FISH AND FISHERIES.

By JOHN ANDERSON.

SALMON.—Our rivers are not giving half the salmon they used to give. Indeed some do not give one-fourth. In the Tay alone have any artificial fry been placed. I have advocated a public hatchery for all Scotland, but cannot get them to see the necessity of having it. Owing to our net fishing being now stopped so early, too many fish get up to our spawning ground and at once they commence to fight and kill one another, then putrify, and get covered over with fungus. It seems to astonish them, although I have seen it on our river banks for the last 60 years, only on a very small scale, according as the quantity get up before spawning.

I send you a few particulars of the run of our salmon, grilse, and trout up our river Forth during the season. I do not know what your views are as to grilse; by many they have always been considered as the young of salmon; but I am happy to say I have now convinced hundreds they are not. Our salmon and grilse are just as different as our geese and ducks. The young salmon approaching our rivers weigh from three-fourths of a pound up to 1 pound in December, and are seen again in February to weigh 3 to 6 pounds. Every spring tide finds them half a pound heavier. They just follow our winter salmon, while our first grilse are never seen before May and then they weigh from 1½ to 3 pounds, and in July 5 pounds and up to 12 pounds. The youngest salmon and the largest have the same distinct marks on them, an oval scale and a crescent tail, while the youngest and largest grilse have a nice diamond scale and mackerel tail. In the third year I have found and pointed them out 20 to 25 pounds each, but our fishermen call them salmon as they obtain a higher price. In writing I only speak for the Forth.

About twenty years ago, when the hatchery was established for the Tay, the old keeper, Peter of the pools, as they called him at Stormontfield ponds, wrote the inspector of the river Tay, saying he could not understand his numerous family of 200,000, for one-half seemed quite inclined to go to sea and the other half or perhaps one-third seemed disinclined to go near the outlet of the pond while the others were leaving by the thousands. Mr. Buist, my worthy friend, wrote me asking if I could enlighten him on such a queer and interesting matter. I at once explained the true cause, namely: The bailiffs when capturing the fish to abstract the ova, as it happened in winter, often during the time ice was on the water or a storm of snow was lasting, had little time to make investigations and might have taken the ova from a good-sized grilse instead of a salmon. Indeed, as they all considered it only a

young salmon, they thought it all the same in mixing them together, therefore they saw the difference only when the salmon were ripe for the sea. The following season they paid more attention and spawned only salmon, and in the spring every one in the ponds left within two days—not one was left. The following season they spawned, as formerly, salmon and also grilse, and next spring again only part wished to get away, proving what I had said.

The government of New Zealand has ten times asked parties to obtain salmon ova and send out to them for their fine rivers in that country. It has cost them thousands, but they never yet received one alive. The government was again thinking of trying to get them out once more when a friend of mine, Mr. Farr, secretary for the Acclimation Society of Christchurch, volunteered to come home and see the friends in England which he had left thirty-five years before, and then to come to Scotland and endeavor to obtain salmon ova. Being introduced to the chairman of our fishery board, he got permission to obtain them from the river Tay. We went, but we were too late. We could obtain ten females, but we could not obtain one milter. Being too late for the river Tay I then set off for the Tweed, and succeeded in obtaining over 140,000 fine ova. I then adopted a plan of my own, and instead of at once packing them up for shipment I conveyed them 60 miles in jars to my son's trout hatchery at Linlithgow, and laid them in the troughs until they became eyed; then, instead of packing them up in fog or moss direct from the boxes or troughs, I caused 48 bottles to be made of a flattened shape, and I placed a small tube through the bung or cork, so as to allow bad air out and fresh air in, and in each bottle I put about 4,000 ova, and had these again hung in boxes with the most easy springs I could procure, and by such I was able to convey them 400 miles by railway to Portsmouth without one dozen being killed.

Mr. Farr then placed them in trays I invented for him—a chest with shallow drawers, into which I make the water to flow from a cistern. It can be regulated as to heat or cold all the way out and the draw or shelf can be examined daily. The drawers are also divided in order to prevent the lurch of the steamer affecting them or disturbing them at all. It will be a wonderful undertaking if such a quantity can be so taken out alive after all their failures. The greater quantities packed before in moss or fog and ice, with the frightful shaking by the railway killed part if not the whole before they even reached the ship.

A number of gentlemen propose getting up, in a park of 35 acres, a grand international exhibition close to our city. As they have asked me to take charge of the fish department and all concerned, and as I see there is plenty of fine water, I propose to lay out several large ponds and have a large hatchery erected for salmon, grilse, and trout. I hope to be able every season to stock every river in Scotland with fry as well as all our burns with trout, at the same time stocking the ponds, say, of a few acres each, with Loch Leven and other trout to allow our youth some

nice angling. Already I have offers for next season from parties willing to send me any quantity of lake salmon and trout ova, so as to give us a good start and have millions of fry brought out. Perhaps you may be able to help us with some of your favorites.

I have one son in Auckland, New Zealand, who has taken a great interest in the hatcheries there. I am now entirely out of business, so I have plenty of time on my hands. My son who succeeded me has no less than 25 salmon fisheries at rentals of £10,000, and has 200 men employed. This season at one of his fisheries in February he succeeded on the river Tay in capturing 1,300 fine salmon.

THE MIGRATION OF SALMON, GRILSE, AND TROUT ON THE FORTH.—From important and lengthy investigations it appears that we have every season five runs of salmon, two of grilse, and four of trout. The first run, or what is called our winter salmon, commences in December with the first spring tide. This is a large, coarse fish, 16 to 30 pounds weight, very lively in the net and bold on the rod. The second run is the first of our young salmon or spring fish. This is a fine-made and delicate-looking fish, and also very lively, which puts in its first appearance in February, weighing 1½ to 6 pounds and rising 1 pound every spring tide. The third run is our summer salmon, a short-made fish, very sluggish in the net or on the rod, first seen in May, 12 to 30 pounds. The fourth run is our autumn salmon, rather a smart fish, gives great play on the line, appears in July, from 16 to 40 pounds, the milt and roe well developed in August. Males have a long beak. The fifth run fish have a distinct, peculiar appearance, being generally of a dark color, some red and spotted. The males have a large milt and a very prominent beak, while the females have a very large roe. They give great annoyance to anglers, leaping and disturbing the water; they run from 12 to 30 pounds. It was always supposed by the old fishermen that they were the real breeders which stock the river. If the autumn is wet, they appear in September; if dry, not till October.

The first run of grilse appears in May, 1½ to 5 pounds. They are very lively and delicate-looking fish. The second run of grilse appears in July, when they are short and broad, weighing from 5 to 12 pounds each. The following year they weigh from 16 to 24 pounds, and are now often called salmon, as the fishermen obtain a higher price for them when so called.

The first run of trout are called lamesmen; in other rivers they are called whitling or herling. They appear in January and again in August; a very neat little fish, 6 to 12 ounces. The second run of trout is called the sea trout; very green and silvery, and a very smart little fish, seldom caught with the fly, but easily with the minnow. They appear in February, 2 to 5 pounds. The third run of trout comprise two different sorts. One has has spots all over; the other below the line. The first is very pale and the second as red as salmon. They run from 1½ to 2 pounds each; are first seen in May, and then in August. The

fourth run is called salmon trout, or bull trout; a strong, coarse-looking fish, and rather dark in the scale. They are first seen in July, 4 to 10 pounds, and some are seen 16 pounds.

The distinguishing marks are as follows: The salmon are known from the grilse or trout by the tail, which is crescent-shaped, and an oval scale, even when seen 1½ pounds and up to 80 pounds. The grilse has a mackerel tail and a diamond-shaped scale, even when only 1½ pounds weight, and continues up to 24 pounds. The trout in general has an oblong scale and square-cut tail, although the salmon-trout tail is nearer the crescent shape.

With every spring tide a fresh run ascends the river, but unless there is a flood they fall back with the tide. The trout spawn first, then the grilse, and then the salmon. The trout fry leave the river first, then the salmon, and then the grilse.

THE MIGRATIONS OF SUMMER AND WINTER HERRING.—The fry of the summer herring on the Forth leave the brackish water, where they have been located all winter, about the month of April, reaching the salmon nets near Queensferry in May, and Largo Bay in June. About this time the old herring leave the deep sea, where they have been all winter, returning to the coast, looking out for a place to spawn, and feeding on the ova of the whitefish which spawn near the shore. The fry meet them along the coast of Fife or Midlothian, and at this time the young herring, being about 6 to 8 inches long, take what is called the dandy-hook. This is a clear hook without any bait on it. From the appearance of sea-fowl the sea appears to be full of them for 20 miles, and well over it. About this time the fishermen try their narrow-meshed nets, and capture a large quantity, but they are unfit for curing. Then towards the end of the month wider nets are adopted, and large quantities of the old or last year's herring are captured. But as too often is the case, the fish, not having gathered into a concise body, get frightened at so many nets, leave the shore, and go out to sea. Then when the fishermen cannot obtain a good capture near the coast they follow the sea-fowl out to sea, and as the nets increase they drive the herring farther and farther out to sea, 20, 30, and often 40 miles, causing a great loss of time and much risk to the fishermen.

This goes on all July and August, and the fish getting ripe are obliged to spawn in mid ocean, and often on so bad ground that fully one-half of the ova is lost. It may happen that a storm sets in and continues a few days, when, few nets being set, the herring seek to get near the land. The fishermen not anticipating such a movement do not use their nets, and therefore a large quantity get near the coast and spawn. But, as too often is the case, some old fishermen, from the experience of former seasons, and by observing the sea-fowls, discover the herring on the spawning-ground, shoot their nets and anchor them over the herring. Then if the herring are strong they lift the nets to the surface. The nets are full of herring, and it has often been seen that from eighty to one

hundred barrels have been secured. Often after the boat was loaded the fishermen had to call on their neighbors to come and empty the remainder of their nets so as not to lose them and the herring. But if the fish are spawning and weakly, so that they cannot raise the nets, then they sink to the bottom, and both nets and fish are lost. The result of this is, the herring remain in the nets until all the meat is eaten off their bones. These lying there all winter frighten the herring next season from coming to spawn. The bones in the nets appear like clouds of phosphorus. This causes the herring to leave the locality for years, as has been found to be the case at many places formerly frequented by herring shoals for spawning, and afterward deserted for many years at a time.

The fry of the winter herring, after feeding from April, leave the brackish water at Culross and Boness and go down the Firth of Forth. When captured in October they are 3 to 4 inches long, with a tough belly, and are called sprats or garvies. In November they are found at Queensferry, and are continually getting larger. If there is very rough weather they get mixed with the summer fry seeking to get up to Culross for the winter, and both are caught in the same net. Often, in December, they are found between Queensferry and Inchkeith. Then they are larger, and some caught measure 6 to 8 inches. In January they go down the Firth, and are found all the way down to the Island of May, then being immature herring. They meet their parents coming in from the sea, where they have been since March after spawning.

My fishermen, while fishing, have traced both the summer and winter herring, after spawning, 40 miles to sea, and found both kinds returning when fishing for them for bait for their large hooks. We have also traced and followed the fry from where they were spawned up the north shore of our Firth, all through the various bays, and up to Boness and Culross, and observed their rapid growth every month as they passed through our salmon nets and otherwise.

DENHAM GREEN, TRINITY,
Edinburgh, March 18, 1885.

55.—ON THE MIGRATION OF BIRDS IN THE SPRING AND AUTUMN OF 1884.

By J. A. HARVIE-BROWN, F. R. S., F. Z. S.

Regarding the unusually extensive migration of gulls to our coasts in 1884–'85, several suggestions as to the influencing causes are readily at hand, but the following appear to have the greatest weight and importance:

As we are informed in "Nature" of February 12, 1885, recent Norwegian explorations in the Spitzbergen seas show that the year 1884 was a very remarkable ice year. "The west side of Spitzbergen was

blocked by a belt of land-ice the whole summer through, while the east side, which is nearly always blocked with ice, was more open than it had been for many years. These conditions, there seems little doubt, depend on the prevailing direction of the winds."

Now, the temperature of water having been lowered by the accumulation of ice along the west coast of Spitzbergen, which is comparatively approximate to the farthest northeast influence of the Gulf Stream, it seems natural to suppose that a deflection of the branch of the Gulf Stream, caused by the colder arctic ice and current, the accumulation of which former was caused by the prevailing north and east winds in the arctic seas, would reach round past the south end of Spitzbergen to the east coast, and would cause the unusually open sea there. But the main channel of the Gulf Stream would still be towards the southwest, and would afford the natural outlet for all manner of ocean life which required certain temperatures, and which, such as Entomostraca, Copepoda, molluscan larvæ, &c., afford food to other higher organisms.

The great quantity of such food which in ordinary summers and autumns accumulates around the shores of Spitzbergen or the warm, shallow summer seas off the north coast of Europe, no doubt retire to deeper water on the approach of winter. In unusually cold seasons the retreat is continued, following the course of the milder Gulf Stream until more temperate seas are reached.

In the course of its retreat it is discovered by vast shoals of fish, which pursue these minute forms of life even to the uttermost limits of its possible extension, up certain firths and inlets of our east coast of Scotland. Naturally, also, the last link of the migratory chain is taken up by the enormous population of gulls and other species of sea-fowl, as we know has been the case in the winter of 1884–'85 in the Firth of Forth.

In the log of the steam whaler Eclipse, Capt. D. Gray (see Report, *ante*, p. —), in summer repeated mention is made of the unusual abundance of "whale food" in the Spitzbergen seas, and I am indebted also to Captain Gray, through Mr. Thomas Southwell, of Norwich, for a record of sea temperatures of the same seas.

Mr. Hugh R. Milne, of the marine station at Granton, sends me some temperatures taken from the Firth of Forth, extending over June, 1884, to January, 1885, taken at three points, namely, Isle of May, Queensferry, and near Alloa. These data, in connection with the vast swarms of sprats or garvies (*Clupea sprattus*) and the attendant thousands of gulls, are useful for future comparisons, and I append them here. It would be interesting to have similarly-taken temperatures of the Tay estuary, which was completely deserted this season by these migratory fish, and consequently by the birds also. If we had also means of knowing the temperature of the Firth of Forth in 1872–'73, when a similar vast migration of sprats and gulls was witnessed, such data would assuredly lead to most interesting, useful, and scientific results.

One great difference in the migration of gulls in 1884–'85 from that in 1872–'73 is that in 1884–'85 there were very few glaucus gulls (*Larus glaucus*) or Iceland gulls (*L. islandicus*), but in 1872–'73 both these species were in vast numbers, comparatively speaking. It seems to me possible that the 1872–'73 migration indicated by those arctic gulls was of even wider and more extensive influence than that of 1884 and 1885; but, of course, there is room here for further study.

Again, while the Tay usually is visited by sprats in great sprat seasons, equally or nearly so with the Forth, and was so visited in 1872–'73, though not to the extent that the Forth was, in 1884–'85 it appears to have been almost utterly deserted by fish and bird alike. The cause was, no doubt, comparative scarcity of entomostracan life, dependent, most likely, upon certain undefined conditions of sea temperature, affected, posssibly from the river basin of Tay and its tributaries. If light can be thrown upon these not-difficult-to-be-ascertained data, in a few years, at most, much of our uncertainty as to the causes and effects of the migrations of Entomostraca, sea fish, and even salmon and migratory Salmonidæ, will be removed.

Temperature of the Firth of Forth, June, 1884, to January, 1885.

Month.	Isle of May.	Queensferry.	Near Alloa.
June (1884)	51	53	58
July	52	58	[60]
August	54	[59]	[65]
September	[53]	54	58
October	53	52	51
November	49	47	45
December	44	44	[38]
January (1885)	[43]	39	35
Range of surface temperature of the water	10°	20°	30°

The figures in brackets were not observed, but are entered hypothetically.

Mr. Milne, in writing to me, adds "I believe that in hot summer days the temperature at Alloa would be 70° or more * * * and during severe winter weather would certainly be down to 32°." My belief is that in October and April the temperature is uniform all over the Firth, and from April till October it is higher at Alloa than at the Isle of May, the difference attaining a maximum between July and August. From October to April it is lower at Alloa than at the May, the difference attaining a maximum about the end of the year. The maximum difference between the two places will be about 10° or 12°, giving a rate of change of 0° 2′ per mile. Suspended matter taken in ten samples at Kincardine-on-Forth varied from 5 to 20 grains per gallon, averaging about 10 grains.*

I personally visited Kincardine several times, both in 1872–'73 and in 1884–'85, and witnessed the extraordinary congregation of gulls and the

* It was at Kincardine-on-Forth, the narrowest part of the Forth, between Alloa and Borrowstounness [—Boness] that the greatest quantities of sprats were taken.

myriads of sprats. In 1884–'85 one smack, anchored off the pier at Kincardine, took 16 tons of garvies (or sprats) in one tide. There were in all some twenty smacks lying anchored at this narrow part of the Firth, but all of these were not fishing with the small meshed nets, some for herring only. Hundreds of tons were sold at from 14*s.* to, latterly, 8*s.* a ton, and were spread over the adjoining farm lands for manure. Hundreds of tons more were sold for making up a compost manure—being considered too rich in phosphates—to a firm in Alloa. Hundreds of tons more besprinkled the mud-flats at low tide, or hung by their gills in festoons along the tangle-covered timbers of the piers. The water itself was alive with them, and every wave that broke on the lower piers left the piers covered with glittering garvies. A man with a landing net could have caught an indefinite number.

Mr. J. T. Cunningham, of the Scottish Marine Zoological Station, Granton, in reply to inquiries, tells me that his notes dating November 28, show that copepods were very numerous and varied, as were also molluscan larvæ. The temperatures of the water, as will be seen by Mr. Milne's notes in December and January, 1885, were lower than at any other time of the year, being 38 and 35 near Alloa and Kincardine as compared with 41 and 39 at Queensferry, and 44 and 43 at the Isle of May. By the 17th of November, as it is recorded in our migration report, garvies were reported as very abundant around the Isle of May, at which time the temperature at that point was 49°, against 47° at Queensferry and 45° at Alloa. These shoals were accompanied by great numbers of gulls at the Isle of May.

As early as March, 1884, vast numbers of gulls were reported to have been fishing off North Unst, in Shetland, for many weeks together, such an assembly not having been before observed by the oldest inhabitant.

I feel convinced that a steady and carefully recorded journal of bird movements will result in very extensive additions to our knowledge of the natural laws which govern them.*

I may add that in the course of perhaps twelve months more we hope to be able to produce some certain data regarding this matter, namely, the relative conditions of temperatures of the Arctic Ocean in the Spitzbergen seas in 1884–'85, with the data already printed in our present report, from inquiries made by Mr. A. Buchan, of the Scottish Meteorological Society, and also the conditions of such data relating to the migrations of Entomostraca and "whale's food." Also we hope to have sufficient data to institute a comparison with the conditions of temperatures, &c., in other seasons.

DUNIPACE LARBERT, *April* 7, 1885.

* Mr. William Evans, a most careful and excellent field naturalist, sends me records of the occurrence of high arctic birds on the Firth of Forth in 1884. The gray plover, knot, and bar-tailed godwit, were seen on August 9th, which, however, was the first day Mr. Evans visited the shore. The sanderling was seen on August 14th, and the little stint on the 20th.

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56.—REPORT ON BLACK COD OF THE NORTH PACIFIC OCEAN.*

By JAMES G. SWAN.

NAME.—The *Anoplopoma fimbria* is known in California as candlefish, Spanish mackerel, grease-fish, &c.; among the Makah Indians of Cape Flattery, Wash., as "beshowe," and by the white residents at the cape as "black cod." On Queen Charlotte's Islands, British Columbia, it is called "coal-fish" by white settlers, and by the Haidah Indians, who reside on those islands, it is called "skil." At Knight's Inlet, British Columbia, it is called "kwakewlth." Each tribe or locality where it is taken has a local name for it, but it is generally known as black cod.

The scientific name, *Anoplopoma fimbria*, has been adopted by Gill, Jordan & Gilbert, and most other writers, although a specimen taken off Mount Saint Elias, Alaska, was named by Pallas *Gadus fimbria* (Proc. U. S. Nat. Museum, 1881, vol. 4, p. 254), thus showing that its resemblance to the cod was observed by that naturalist. The term "cod" is applied by fishermen and fish-dealers on the North Pacific coast to a variety of fish which are not related to the genus *Gadus*, and are not found in Atlantic waters. The *Ophiodon elongatus* is called, in San Francisco, buffalo cod, green cod, blue cod, &c. At Cape Flattery the Makah Indians call it "tooshkow." The whites call it kultus cod or inferior to true cod. The different varieties of *Sebastichthys* are known in the Victoria and San Francisco markets as rock cod, but do not resemble the rock cod of New England in any manner, being more like the perch, having a remarkable development of sharp bony spines and prickles. The popular name of black cod applied to the *Anoplopoma fimbria* does not seem any more of a misnomer than to call the *Ophiodon elongatus* blue or green cod.

DESCRIPTION.—In general appearance the black cod resembles a pollock, but when fully grown they have the rounded form of a true cod, but are not so marked. In color they are a dark olive brown or sepia on the back, with grayish sides and belly; the flesh is white and very fat, like mackerel, and they have been sold in San Francisco under the name of Spanish mackerel when of a small size. Professor Jordan says: "The young ones are taken off the wharves at Seattle, but are not much thought of as a food-fish. It attains its greatest perfection in very deep water, where it attains a size of 40 inches and a weight of

* *Anoplopoma fimbria* (Pallas) Gill, or black cod of the North Pacific Ocean; beshowe, Makah Indians, of Cape Flattery, Wash.; skil, Haidah Indians, of Queen Charlotte's Islands, British Columbia.

15 pounds." Instances are not uncommon of black cod being taken measuring 50 inches and weighing 30 pounds, but the average is much less than this last. But it is the admitted rule that the deeper the water the larger the fish.

The black cod (*Anoplopoma fimbria*).

WHEN DISCOVERED AND ITS DISTRIBUTION.—Although I have the credit of first introducing this fish in a marketable shape to the public, yet it has been known to the officers and employees of the Hudson's Bay Company for many years, but was seldom seen on their tables; the enormous quantities of salmon, eulachon, herring, cod, halibut, and other fish, easily and plentifully taken, made it unnecessary to incur the trouble of fishing in the deep water for the black cod. The first I saw of them was at Neah Bay, Wash., at the entrance to Fuca Strait, in 1859. An old Indian caught a few when fishing for halibut. I procured one, which I broiled, and found it equal to a No. 1 mackerel.

They called it "beshowe," but the white settlers, from want of a better name, called it black cod. The true cod, *Gadus*, is called by the Makah Indians "cardatl." The kultus cod, *Ophiodon elongatus*, they call "tooshkow." As the black cod are best in water from 80 to 100 fathoms, the Makahs do not care to fish for them, and when by accident they catch any they ask one dollar apiece, and do not care to part with them even at that price. I have occasionally seen the "beshowe" every summer that I have been at Neah Bay since 1859, but I never have had an opportunity to get any quantity of them till in September, 1883, while at Skidgate, Queen Charlotte's Islands, which I visited under instructions from Professor Spencer F. Baird. I succeeded in procuring about 100 of these fish, which are called by the Haidah Indians "skil." These

Indians take them in considerable quantities on the west coast of the group of islands, in the deep waters of the inlets and harbors, for the purpose of extracting the oil or grease, which is used as food by the natives, and is similar in appearance to the eulachon grease, which is of the color and consistence of soft lard.

From Monterey to the Arctic Ocean the *Anoplopoma* are found, but when young they are not considered as good for the table. They are caught, according to Professor Jordan, "from the wharves at Seattle on Puget Sound, by the Chinese at Monterey with set lines, and in San Francisco with sweep nets. It feeds on crustaceans, worms, and small fish, and reaches a length of 40 inches and a weight of 15 pounds; those usually seen rarely exceed 2 or 3 pounds. As a food-fish it is generally held in low esteem, although sometimes sold as Spanish mackerel. The large specimens taken in deep water about Vancouver Island, known to the Makah Indians as 'beshowe,' are highly valued as a food-fish, according to Mr. Swan" (Proc. U. S. Nat. Museum, 1881, vol. 4, p. 54). Hitherto the black cod have not been introduced among the whites as a food-fish, owing to a prejudice of some tribes against fishing for them to sell, of which I will make mention in another portion of this paper.

The officers and employees of the Hudson's Bay Company have known of the existence of the black cod for many years; but as salmon and halibut have been so exceedingly plentiful, no steps have been taken to engage in the fishery to develop it.

Alexander C. Anderson, Esq., inspector of fisheries for British Columbia, in his report to the minister of marine and fisheries, Ottawa, Canada, for 1860, says (pp. 286 and 287), while referring to Massett Harbor and the adjacent waters near North Island, Queen Charlotte's group, British Columbia:

"A species of fish is caught in these waters which I have frequently heard mentioned in terms of high praise, but of which I have never met with a specimen. I am therefore unable to say to what variety it may belong. For want of a better name it has obtained that of coal-fish, though, it is said, not from any real resemblance to a fish of that name found in Atlantic waters. Mr. McKenzie, Hudson's Bay Company's agent at Massett, says of the coal-fish: Length about 24 inches; back dark color; belly gray. Inhabits very deep water, and said to abound in the vicinity of Virago Sound. Indians fish with a long line, with about ten hooks, and generally haul up as many fish. This fish yields a large quantity of oil, which is used as an article of food and highly esteemed by the natives, but is not much fished for. Obstacles to prevent Indians from making it a business, depth of water, difficulty of anchoring canoes, strong currents, and necessity of calm weather. From others, now and in times past, I have learned that, from the richness and firm consistence of its flesh, this fish would bear salting equally well with the salmon, which fish, indeed, with doubtless exaggerated praise, some

have declared it to excel. Withal, I do not question that with time this fish will prove, with the aid of proper vessels and needful appliances, a valuable adjunct to the resources of the provincial waters, either as a market fish or certainly for the extraction of oil."

The fish above mentioned by Mr. Anderson were caught by the Indians in Parry Passage, between Graham and North Islands, Queen Charlotte's group; but along the west coast of those islands, particularly at Chaatl, near the western entrance to Skidegate Channel, and south of that place, at Stunthlai, near Tasoo Harbor, the water is much deeper than in Parry Passage, and the fish much larger. Instances are not rare of specimens being taken measuring 50 inches long and weighing 30 pounds, although the average fish caught in shallow water will weigh from 10 to 15 pounds each when fresh, and before being dressed.

The black cod are found in the deep waters of Fuca Strait, between Port Angeles and Cape Flattery, a distance of some 60 miles, where they attain a large size, and are highly esteemed as a food-fish, but the same objection regarding Indians catching them in that locality exists, such as is mentioned by Mr. Anderson, as quoted, *e. g.*, "depth of water, difficulty of anchoring canoes, strong currents, and necessity of calm weather." Added to this, may be stated that the Indians have such a variety and quantity of other kinds of fish in shoaler water easily taken, such as halibut, ophiodon or green cod, *Sebastichthys* of many varieties, salmon, kelp-fish, and herring, they seldom care to fish in deep water for black cod, and when they do it is to obtain them as a luxury for their chiefs.

It is only the Makah Indians who take these fish on the American side of Fuca Strait, but their fishery is limited, as hitherto there has been no demand for them. Further north, along the west coast of Queen Charlotte's Islands, they are very plentiful in all the fiords and inlets where the water is deep, but are not taken by the Indians, owing to causes before mentioned. On the west coast of Queen Charlotte's Islands they are very plentiful, and the Haidah Indians catch them for their oil, which is used as food. These fish are also plentiful in the waters of the various inlets of the mainland; but the Indians of those tribes obtain their supplies of grease from the eulachon or candle-fish, and the herring. They also abound in the waters of Alaska, particularly the Prince of Wales Archipelago, where they have long been known, and a few have been pickled from time to time by white persons for their own use. The reason why this fishing has been so long neglected is that other fish are so abundant and so easily taken that the Indians obtain their food supplies from them.

The superstition some of the tribes have had about allowing white persons to catch these fish, to which I have alluded, may be illustrated by the following anecdote, which is but one of hundreds that could be told of similar Indian prejudices:

The late Capt. Edward Brotchie, for whom Brotchie's Ledge, near Victoria, was named, fitted out a small vessel in 1853 to engage in the

fishery for eulachon, *Thaleichthys pacificus* (Rich.) Grd. He took a quantity of salt and small kegs or half barrels in which to pack the eulachon, which are a small fish, in size and appearance like the smelt. He proceeded to Knight's Inlet, which makes into the mainland from the southeastern portion of Queen Charlotte Sound. The eulachon run up this inlet every spring in myriads, and are followed by halibut, black cod, green cod, cod, dogfish, and every other variety of fish found in those waters, which prey upon them for food. They are taken in immense quantities by the Indians of Knight's Inlet for food and oil, and as articles of trade with other Indians.

When Captain Brotchie arrived at the village at the head of the inlet, the Indians utterly refused either to sell, give, or allow him to catch any eulachon. In his dilemma a friendly Indian told him he could have as many of the "kwakewlth"—the name they give the black cod—as he wished, for they were plenty and fat; so with their assistance he filled all his barrels and started for Victoria with his cargo. But before he had got out of the inlet the old medicine men had a consultation, and decided that if the white man was allowed to take away the "kwakewlth," the eulachon would be ashamed and never come back. So a party of young Indians followed Captain Brotchie in canoes, and having boarded his vessel, they deliberately knocked in the heads of every one of the barrels and emptied the fish overboard. The captain was then allowed to return to Victoria with his empty barrels.

I mention this incident to show how abundant the black cod were thirty years ago, and they are fully as abundant now, and there is no fear of any Indian interference with any parties who may wish to engage in the fishery at the present time.

Since Captain Brotchie's unsuccessful voyage for eulachon no one has attempted to put up the black cod in any quantity for market, and the lot I took to Victoria dry-salted in boxes, were the first ever seen in a merchantable condition in that city, and the four boxes I sent to the United States Fish Commission are the first ever exported from the province of British Columbia, a fact to which special reference was made by the collector of customs of Victoria in his quarterly report to the minister of finances in Ottawa.

CAPTURE.—As the Haidah Indians seem to be the only ones who make a business of taking the black cod or "skil," I will confine myself to a description of the method adopted by them.

Their lines.—The fish-lines used in the capture of the black cod are made of kelp, in a manner similar to that of the Makahs, of Cape Flattery, and other tribes on the northwest coast.

This giant kelp, the *Nereocystis* (Harvey) is of the order *Laminariaceæ*, and is of much larger dimensions than the *Fucaceæ*, the fronds being measured by fathoms, not feet.

Harvey says:* "The ordinary oarweed, tangle, devil's apron, and

* *Nereis Boreali Americana.* Harvey, 1858.

sea-colander of the American shores, which are familiar examples of these plants, are frequently seen 10, 12, or even 20 feet in length, with immense fronds or aprons terminating their stems; but these are mediocre, indeed, compared with some of their co-ordinates in the Pacific. Some of these plants, it is said, when fully grown, have a stem measuring 300 feet in length. These grow where the water is rapid, and have to extend to a great length before their buoyancy will permit them to reach the surface. For about two-thirds of this length from the root up, the stem is about the size of a halibut line. It then expands till at the extremity it assumes a pear-shaped hollow head capable of holding a quart, and from which extends a tuft of upward of fifty leaves, lanceolate in form, each of which is from 40 to 50 feet long. The slender stem is of prodigious strength, and is prepared by the native for use as follows: The stems being cut of a uniform length, generally 15 or 25 fathoms each, are placed in running fresh water till they become bleached and all the salt is extracted. They are then stretched and partially dried in the open air, then coiled up and hung in the smoke of the lodge for a short time. Then they are wet and stretched again and knotted together. This process is continued at regular intervals till the kelp stem becomes tough and as strong as the best hemp line of the same size."

After using, it is always carefully coiled up; but as it gets brittle if allowed to dry too much it is invariably soaked in salt water before being used.

The hooks.—The hooks used by the Haidah Indians for catching the "skil" or black cod are of a peculiar shape, unlike any fishhook I have ever seen; they are made of the knots or butts of limbs of the hemlock, cut out from old decayed logs. These knots are split into splints of proper size, then roughly shaped with a knife, and then steamed and bent into shape, which shape they retain when cold. This form is adopted, so the Indians informed me, because the bottom on the west coast is very foul with stones and coral formations and incrustations; steel hooks get fast and lines are subject to being lost; but this style of hook does not get fast.

When the book is to be used, the bait is tied on with the string which is used to bring the two ends of the hook together and keep them in position when not baited. After the bait is well secured, a piece of stick is inserted to press the ends of the hook apart. When the fish bites the bait, it knocks out the stick, which floats to the surface, the two ends of the hook, springing together, close on the fish's head and hold it fast. It is usual to tie from seventy-five to one hundred hooks to the line, at a distance of about 2 feet apart, and the fish are so plentiful that not unfrequently every hook will have a fish. The sticks which floats to the surface, when knocked out of the hook by the fish, serve to indicate to the Indian the sort of luck he is having at the bottom. But although the fish may be adundant, the Indian is not

always sure of securing what he has caught. His greatest annoyance is the ground-sharks or nurse-fish, as the sailors call them, which will often eat the bodies of the black cod, leaving only the heads attached to the hooks. Another annoyance is from a small fish called by the Haidah Indians "nee-kaio-kaiung," the *Blepsias cirrhosus* (Pallas) Gün., one of the family *Cottidæ*, which steals the bait and often gets hooked; as soon as the Indian discovers this pest he quits fishing and goes to another place.

As the depth of the water varies in different places it is usual to have a lot of spare lines in the canoe which can instantly be knotted together and form a line as long as required; sometimes 200 fathoms will be used, as the line when fully supplied with hooks becomes a trawl.

The sinker.—A most ingenious contrivance is the sinker used by the Haidahs in this deep-water fishing. This is a stone, from 10 to 20 pounds in weight. A small kelp line is wound round this stone and held by a bight tucked under the turns, and the end made fast to the end of the larger line, which large line is wound round this stone, and a smaller stone which serves to bind it fast and as a sort of tripping-stone. The large line is secured in a similar manner as the small line, by a loop or bight tucked under the turns. The stone is then lowered to the bottom and the line paid out. As soon as the fisherman sees enough pegs floating to warrant his pulling in the line, he gathers in the slack till he feels the weight of the stone, when he gives a sudden jerk, which pulls out the bight and loosens the tripping-stone, which falls out and loosens the big stone, which in turn becomes detached from the line, which is then pulled in relieved of the weight of the sinker.

METHOD OF CURING THE BLACK COD.—On my arrival at Skidegate, in the last of August, 1883, I arranged with Mr. Andrew McGregor, one of the partners in the Skidegate, to send some Indians to the west coast to procure some black cod. He sent four Indians, Scanayune, Ske-at-lung, Ingow, and Skatsgai, who all belong to the Gold Harbor band on the west coast. I sent a sack of salt with the Indians, with instructions to take out the gills, remove the viscera without splitting the fish, and then fill the cavity with salt, which was done, and the fish were received in prime condition.

On the 2d of September, Scanayune returned with twenty fine fish. A council was now called to decide the best way to split them. There were a number of eastern fishermen present, who were the crew of the little steamer Skidegate, engaged in dogfishing for the oil works. Some were of the opinion that the fish should be split in the back, like a salmon; but I objected, as I thought people would say they were the white-flesh dog-salmon and be prejudiced, so I had them split and dressed like cod, and well salted in a vat. But now my trouble commenced. I was of he opinion, as were all the others, that the fish should be barreled like salmon; but we had no barrels or coopers, and the question was how to get them to Victoria without rusting, for we all thought that so fat

a fish would rust like a mackerel or salmon. At last I recollected how I had seen halibut treated when it was to be smoked, and I decided on that plan. After the fish had been in salt two weeks, I rinsed them in the pickle they had made, and piled them skin side up, put planks and heavy stones on them, and so pressed out the pickle. After they had been four days under this pressure I found them hard and firm, and beautifully white. I then packed them in boxes, which I made for the purpose, putting twenty fish in each box and filling up with dry salt. My intention was to repack them in Victoria and put them in barrels, but on examining the boxes on my arrival I found the fish in such fine condition that I was advised by experts of the Hudson's Bay Company to send the fish forward just as they were; and so well satisfied were the officers of the company with the plan I had adopted through necessity, that the chief factor, William Charles, Esq., instructed the Company's agent at Massett, Mr. McKenzie, to procure all the black cod he could get from the Indians, to cure them in every respect as I had done, and to pack them in similar packages, as it was thought they would take better in the London market.

QUALITIES OF THE BLACK COD.—I tested the fresh fish in every manner I could think of. I had the livers, and we fried and found them delicious. The females were full of eggs, which I found very small, about the size of herring spawn. This was the 1st of September, but I had no opportunity of ascertaining the spawning season or their spawning ground. I tried the tongues, but did not like them as well as codfish tongues, as they were quite small.

The fish does not make a good chowder, as it is too fat, the heads, however, after having been salted, we found made excellent chowder. The best way in which the fresh fish can be cooked, is to broil it like fresh mackerel, or roast it before the open fire like planked shad. After it has been salted, as I salted those I put up, it should be cooked by first soaking till the salt is well out, then simply boiled, and served with plain boiled potatoes. Made into fishballs it excels any fish I have eaten.

THE BLACK COD DOES NOT RUST.—On the 6th day of October, 1883, I gave George Vienna, the fish-dealer on Government Saint Victoria, one of the black cod, which he hung up in his stall for every one to examine. On the 17th day of December I examined the same fish, which had been exposed to the weather in the stall all the time, and it was perfectly sweet. Mr. Vienna said it never would rust; it was too well salted. A gentleman of Victoria, who had eaten of the black cod heartily on several occasions, told me that he is unable to eat either salt salmon or mackerel, as the oil of these fish does not agree with his digestion, but he experienced no such effect from eating the fat black cod, and mentioned the fact as something to be noticed.

ECONOMICAL MANNER OF PUTTING UP THE BLACK COD.—Now that the experiment of my method of dry-salting the black cod has proved

a success by the encomiums passed upon the excellence of that fish as tested by the experts of the Boston Fish Bureau, who are undoubtedly some of the best critics and judges of fish in the United States, I wish to call attention to the economy of my method for the poor settlers on our northwest coasts of Washington Territory and Alaska. All that is required for outlay is the cost of the salt for curing the fish, and the nails for making boxes, which can be made from the white spruce which abounds on the coast, from the Columbia River to Western Alaska. This wood splits as easily as cedar, is perfectly sweet and free from resin, as all the gum is contained in the thin ring of sap-wood and bark. The inside is free from resin. This will make the cheapest and best of boxes and save the expense of coopers and barrels, and the fish being of full size is better adapted for smoking than the same fish cut and barreled.

THE FISHERY FOR THE BLACK COD.—A very important question to be answered is, will the black cod be taken in sufficient quantities to supply the demand which is likely to spring up wherever their rare excellence is known? I think that at present the supply will be limited, as there are no fishermen on the North Pacific coast who have the appliances or the experience in deep-sea fishing as practiced at present on the Atlantic coast. Our coast fisheries are exclusively confined to salmon, which are taken in the rivers with nets and seines. The very few cod and halibut brought to our markets are taken with hand-lines and old-fashioned trawls, but it is rare to find any fishermen working in more than 30 fathoms of water. Our waters teem with fish, but as yet, with the exception of salmon, no organized plan has been tried for taking quantities of fish. What we want are Eastern fishermen with Eastern capital and Eastern methods of taking fish. If such men would come out here they can find plenty of black cod, but they will be found in deep swift water, where at times it is pretty rough. But to a "Grand Banker" or a "George's Banker" our most turbulent waters would be but a plaything.

In order to develop the fisheries of Puget Sound and the Alaskan waters there should be some regular wholesale fish-dealers established, who would take everything the fishermen would bring, and find markets themselves. Our fishermen are too poor to send their fish to a distant market; but let a wholesale dealer with capital establish himself, and he would find fish would be brought from all quarters, white men and Indians working with a will to catch fish which would bring them ready money.

There seems to be considerable interest evinced in British Columbia about the black cod, and several vessels will be fitted to go north in the spring; but on Puget Sound no one as yet seems to show any interest. Those who have means are not willing to embark in the business, and those who would like to develop it have no capital to work with. I think, however, that the prospect of an Eastern market may

induce some of our citizens to try their luck on black cod during the coming summer.

THE SEASON FOR BLACK COD.—I very nearly omitted an important point, and that is, the best season of the year for taking black cod. I find that in the spring, when the eulachon run up the inlets and streams, where they spawn, the black cod follow them, and can be taken in quantities; but I am informed by both Haidah and Makah Indians that the black cod can be taken in the deep water at any season of the year when the weather will permit fishing. There are undoubtedly certain seasons which are better than others for taking this fish, but as yet no one has made a study of their habits.

PORT TOWNSEND, WASH., *January* 9, 1884.

57.—UNUSUAL ABUNDANCE OF COD ON BROWN'S BANK.

By Capt. J. W. COLLINS.

The hand-line cod-fishermen who have arrived recently report fish unusually abundant on Brown's Bank, though they are scarce on George's, as is generally the case at this season.

Capt. William Dempsey, master of schooner Clara F. Friend, who has had upwards of twenty-five years' experience in the George's cod-fishery, arrived last Monday—May 25—from a trip to Brown's Bank. He was absent from home eighteen days, seven days of which were spent at anchor on the Bank. In this time, with a crew of 10 men, a fare of 37,000 pounds of fish was caught, 1,400 pounds of which were fresh halibut, the remainder being salt cod. The schooner lay in 45 fathoms, about south-southeast from the "Shoal-water," in north latitude 42° 46′.

Captain Dempsey says he never before saw cod so abundant on Brown's Bank, at this season, in all his experience. Not only were they plentiful near the bottom, but they appeared to be numerous nearly to the surface of the water. Many fish were caught "up in the water," and on one occasion Captain Dempsey hooked a pair of fine cod not over 10 fathoms from the surface. "High-course" tides prevailed while the vessel was on the ground, and they ran so strong that much difficulty was experienced in making the gear "tend" bottom. After a little while, however, it was found more profitable not to veer out any more line after once getting bottom, for, as the swift-running current gradually lifted the leaden sinkers from the ground, fishermen were more liable to catch pairs of fish than if they exerted themselves to pay out their lines at intervals, which is the usual method when fishing in a tide-way. These cod were in spawning condition, according to Captain Dempsey, who tells me that the milt ran freely from the fish after they had been landed on deck. Before he left the Bank, several schooners came there from George's, where they reported finding fish very scarce.

GLOUCESTER, MASS., *May* 30, 1885.

58.—CARP CULTURE IN CHINA.

By D. J. MACGOWAN, M. D.

Minister Young having desired Consul Stevens, of Ningpo, to institute inquiries concerning the culture of fish and especially of carp in China, I cheerfully respond to Mr. Stevens's request for aid in the matter; not because of any intrinsic value that my research may possess, but again to manifest my readiness to co-operate in undertakings that have for their object the introduction into our country of appliances and industries which this ancient and ingenious race has developed in the long march to its present state of civilization.

Pisciculture was cultivated as an industry at an early period, having been regarded a branch of agriculture. A treatise on "Rearing Fish" is ascribed to Fanli, a famous minister of the State of Yu (modern Chehkiang), fifth century B. C. He is renowned for promoting industries which enriched the country, and by which, in retirement, he amassed enormous wealth, chiefly by rearing stock. Tradition says he constructed carp ponds and planted mulberry-trees on the margins, on which apiaries were placed, the droppings from which fed the fish, while the leaves of the tree nourished first silk-worms and then goats.* That work, however, on fish-culture was not by Fanli; it appears to have been composed in the third century A. D., and has been long lost, but there exists a quotation from it in a work entitled "Important methods of maintaining population," written about a century later, which will serve as an introduction to the subject in hand, premising, that while carp, especially, is the most frequently reared by artificial means, nearly every species of *Cyprinidæ*, bream, tench, roach or rudd, goldfish, &c., is so raised.

"Now, of the five modes of rearing animals, by far the most productive and valuable is fish-breeding. Let the pond be an acre in extent (depth not stated, they are usually less than 8 feet); construct in it nine stone islets, each having eight inlets or bays, a yard below the surface of the water; select 20 spawning carp and 4 males, all 3 feet long; deposit them noiselessly during the month of March. Two months later place in the fish-pond a turtle, two months later a couple, and after a like period 3 turtles, by which time there will be 360 carp. The turtles are to prevent their being transformed into dragons and flying away.† The object of the islets and bays is to afford greater space for

*Ravines at Snowy Valley, Ningpo, abound in hives, which, by their droppings, nourish a variety of the carp family, a bream, imparting to the fish a peculiar flavor. What gives mutton from silk districts its excellence is the mulberry leaf.

†This refers to a belief that this prolific fish changes into that fabulous monster. In the Yang period, when Taoism was in the ascendant, carp were held sacred; when netted, the law required their restoration to the stream, and sixty blows was the penalty for eating one.

the fish in their sinuous voyages, for the more a fish travels the fatter and bigger he becomes. The pond should present the features of a river or lake. The pond will be found to contain

First year.		Third year.	
Length.	Number of carp.	Length.	Number of carp.
1 foot	150,000	1 foot	100,000
2 feet	10,000	2 feet	50,000
3 feet	450,000	3 feet	50,000
		4 feet	40,000

"Retain 1,000 of those that are 2 feet long for replenishment; send all the rest to market. In another year the number will exceed all calculation, and they require no feeding; hence the value of carp-culture."

It is the practice in some places to feed them with grass, straw, rice, wheat bran, &c., according to the nature of the fish. Ponds are less elaborately constructed by moderns, but to a certain extent the ancient model is conformed to. The narrative will appear less overdrawn when the nature of the soil to which the writer refers is considered; for the lakelets and pools of reclaimed deltas, containing perhaps the most fertile alluvium in the world, its land and water teeming with animal and vegetable life, afford profuse supplies for the sustenance of fishes.

Although the author says the carp maintain themselves, there is considerable attention paid in many places to supplying them with grass, straw, aquatic plants, and rice or wheat bran.

A modern author recommends three contiguous ponds in a fertile soil; a small one, about 10 feet square, 7 or 8 feet deep, with a pool half that size, and 2 feet lower, the bottom of which is to be well pounded; a middle size, 20 to 30 feet square, at least something over 5 feet deep; and a large one, two, three, or more hundred feet, according to the extent of culture desired. The larger ponds should be at their northern ends a foot deeper, to afford a cool gathering place for their inmates; and into that portion the food should be cast.

In April, stock the small pond with 600 bream and 200 tench an inch long, feed them at regular intervals twice a day with grass, or, in default of grass, shells of eggs that have been preserved in salt, which should be kept in store for that purpose. In June arrange for the transfer of the fish to the middle-sized pond, by spreading out a sheet supported by poles; scoop out the fish with a cloth net, place them on the sheet, and make a separation, the bream and tench by themselves (all other fishes being sent to market), to be placed in the middle-sized pond, which is to be prepared in the spring, by removing its occupants to the large pond, draining and planting it with an aquatic vegetable (*Semanthemum?*) when the bottom is half dried. By April this plant will have attained its growth and afford nourishment for the fish. In February or March following transfer them to the large pond, when they will be

found to weigh 4 or 5 pounds, and in the last reservoir, by autumn, they will become a pound or more heavier, and there they may be fed with old straw, chopped and mixed with pond mud or clay; straw saturated with wine is best; the compost rolled into balls the size of a bowl is to be thrown at night into the deepest part of the pond, when it is instantly swallowed. The same is used for the second-sized pond, but chopped finer and cooked in water before being mixed with earth. Sweep goats' or sheep's droppings into the pond for the tench, on which secretion the bream feast, thus saving grass, but this is slightly detrimental to the animals. If duck-weed is not thinned out the fish will die from overcrowding. In a hundred days the fish in the large pond should have 250 pounds of straw. They are marketable in October or November.

In the autumn they hang them up to dry near the chimney, and in spring cast them into ponds. The vitality of these ova is remarkable. If, says one writer, when they are dried, they are kept from contact with salt, they will hatch three years afterwards. Desiccated places, that have not been reached by water for ten years, on receiving that element have immediately afforded fish. They have been observed on banks from which water has receded for long periods, and again attained its former level.

The lacustrine region of Suchau supplies neighboring departments with carp and its congeners. When captured in the lakelets the minnows are only a line in length, but they double that daily for some time, and require to be dispatched with all possible speed to their places of designation. To facilitate that operation, barriers that are closed by night to all other boats are required by law to be opened on the approach of vessels freighted with young fish.

From the chief of those lakes (the Taihu) the imperial gardens were once stocked by cutting grass from its banks having impregnated ova; the grass was dried and safely conveyed to Shensi, more than 1,000 miles distant. On the upper tidal portions of the same district, at flood, waters are admitted into fish ponds, where marine and river congeners of the carp an inch in length are reared for the Shanghai market; and although they feed exclusively on mud, in the space of six months they attain a larger size, not often having an earthy flavor.

Carp that are bred and reared for ornament do not probably come within the scope of the inquiry submitted to me, yet amateur carp culturists may expect something in relation to the unique goldfish, as this (Chehkiang) province is their original habitat, whence they have spread over the world. I shall not be pardoned if I wholly ignore those varieties of *Cyprinidæ*. Their study merits attention from naturalists who investigate the modification of species through cultivation and domestication, a subject that does not require to be considered in this paper.

Approximatively, the eleventh century A. D. may be assigned as the time of the first observation of those fancy carp, although a Han author appears to allude to them.

All the numerous varieties come from a black species; in domestication they are first black, subsequently going through several changes; those that become white change to silver or yellow, the black becoming red and then golden. Some of the white are so nearly transparent that their viscera are visible. What was for many ages cultivated as a secret art has become public, although the popular belief that their colors were due to red-headed worms found in garbage (probably an invention of carp-culturists) still prevails. Much of the art consists in affording due amounts of shade and sunshine, in the course of their growth, and in changing their water; not more than half is to be removed at once every fourth or fifth day.

They are no longer considered edible. Their food is the larvæ of insects that are skimmed from the surface of stagnant waters; still better are the ova of shrimps, given but sparingly. Aquatic plants float in the jars in which they are kept. Those receptacles which are old, or have been used as latrines are preferred; they hold half a hogshead of water, and are sunk half way in the ground; they must be without rims.

Perhaps the origin of abnormal carp may be referred to a fish that partakes, according to description, of the carp and bream that is found in the chief river of Chehkiang, Chientang. It is "five-colored [variegated] or from a many-colored carp found in an ancient well in the adjacent province, Kiang-Si, with four caudal fins, like a dragon." In droughts it was taken to the Palladium Temple, and invoked for rain; when put into the lake it found its way back to the well. Disease had probably something to do in the production of some of the markings, for an author feebly combats the vulgar notion that they are due to an eruption. Carp generally, and many fish, suffer from a disease that is indicated by whitish spots on the body.

The normal golden carp, of Chehkiang, has congeners in caves and chasms of Pichchi Mountain, in Shensi; "golden-striped carp," and a tortoise-shell variety are found in Honan.

Red eels and red turtles are met with, though rarely, probably being spontaneously produced.

Foreign writers on China have stated that the Chinese skim impregnated fish eggs from the surface of the rivers, and that they are hatched in pools. This is such an extensive country that one should hesitate to deny any statement respecting it which is not obviously erroneous. I can only say with regard to this matter that after much inquiry I am unable to confirm the statement, though it has been authoritatively made. Possibly it arose from the common practice of collecting the larvæ of mosquitoes and other insects; which is an important industry in itself.

Interspersed through various ichthyological essays a few remarks occur on the treatment of fish maladies. Parasites of the size and shape of flattened peas attack carp and other fish; waters from mountain streams bring poisonous matters from serpents, which give origin to

infusoria and parasitic animals, causing fish to become emaciated. The remedy is found in throwing in some pine leaves, which will cause the parasites to disappear.

There is a distemper which causes fish to float helplessly on the surface of the water. It is caused by their eating the droppings of pigeons, or by washing grass-cloth plant (*Ninea*) near to the pond, which causes them to float in the same manner. Treatment: night-soil. Eating their own secretions too freely induces a like disorder; subject them to the same remedial agent. When fishes are found floating on their backs they will soon die.

A curious statement is made respecting an olden-time direction to quicken the hatching of bream. "Open a bream with a bamboo knife, place in its abdomen some brassica pounded with water and a minute portion of quicksilver, roll up the fish in the same vegetable and suspend it forty-nine days, then reopen and deposit the fish in water, and almost immediately the ova will become fish." That member of the carp family, like certain *Chondroptergii*, must have been impregnated before secreting ova.

The rocky creeks of the Chientang prove fatal to young carp, bream, and tench, from colliding with stones, which suggested the construction of ponds on the banks for preserving them. The minnows perish unless the pond is emptied and fresh water let in, with some bruised banana leaves, which will restore them to health. Fishes that as small fry have been nutured on the yelk of eggs are sterile. In supplying ponds with duck-weed or other aquatic plants, be careful lest the ova of mullet, and the like, should be adherent; those fishes are destructive to all members of the carp family. To protect ponds from pigeons' droppings, grape-vines should be grown on trellis-work over ponds.

When ponds are too deep fish suffer from cold, and also in winter when confined to ponds that are too small. When the frontal foramina of *Cyprinidæ* do not freely open when young, their growth is arrested, and if that obstruction should continue for a year or so they will die; such are to be sent to market.

Decoying male fish of the carp family by imprisoned females is well known to be a common practice in this country; on the other hand, in the shallow, clear mountain streams of Chehkiang, males are used to entrap females, one being tied to a string and dropped into a brook, when he is seized by a large number of the other sex. Seizing him by their mouths their tenacious hold enables the Chinese fisherman to grasp with his hand as many as ten at a time.

The foregoing relates mainly to the marshy coast region; inland, carp culture commences by netting carp minnows in the Yangtse. In the spring that great river is the resort of many thousand carp-catchers, who come from distant regions to pursue their vocation; coming from the head of tide-water at Kiukiang, nearly as far up as the gorges or rapids at Ichang, a distance of 600 miles. So important is that commercial fish-

culture considered that the Government supplies needful appliances for the occupation, reimbursing itself by an impost on the first harvest.

Stakes planted a short distance from the shore at right angles and under shelter of projecting points, afford support to netting gear, which are placed to receive the newly-hatched carp as they descend the stream. The fry, about $\frac{1}{12}$ inch in length, are removed to jars placed on the bank, and fed on a minute quantity of the yelks of boiled eggs mixed with bran; later, on aquatic grass (*Hydropyrum latifolium*). The jars are stored in junks, and when well laden the finny freight is conveyed up the affluents and lakes of the Yangtse, supplying agriculturists and fish-dealers, and thereby contributing largely to the food supply of the Great Valley. Farmers stock their ponds, fish-dealers their inclosures in lakes and rivers, and humbler husbandmen purchase a few to inclose in cages which are fastened to water-banks.

When first taken the minnows are fed on aquatic grass. *Hydropyrum latifolium* is given to the young of all fish. Wheat and rice bran are given at almost every state of their growth, but often when they have matured they are left to provide for themselves. Some fatten on grass, and are called "grass carp;" some on snails, "snail carp." It is recommended to place the animals when young in a tank or very small pool, and afterwards temporarily in a larger place, having grassy banks.

When they are a foot in length they should be transferred to large fish-ponds. In autumn all that are found not to have grown are to be removed and sent to market as hopelessly stunted (the largest carp are 7 or 8 feet in length). Domesticated fish are not to be left in shallow ponds in winter, lest they perish from cold. Willow trees should not overshadow a pond, as their flowers are poisonous to fish.

Nothing is said by the Chinese to indicate that they resort to manual operation in artificial fecundation—pressing out spawn and milt.

In concluding a subject that is far from having been exhaustively treated, it may be worth while to add that one of the *Cyprinidæ*, a tench, was formerly utilized in the hills of Canton for reclaiming and fertilizing wild land. A piece of jungle was terraced and leveled, water let in from above, or by water-wheels from below, and the place stocked with the fish, which, in a year or two, grubbed the grass and roots and fertilized the ground. The fish were then sent to market, and their pasture planted with rice.

It is almost superfluous to remark in these desultory notes that cultivated carp are inferior in flavor to the free-born and wild.

I have not described minutely the carp-catching appliances used on the Yangtse, as models can be procured if it should be deemed of sufficient importance.*

CUSTOM HOUSE, WENCHOW, *Chêhkiang, June*, 1885.

* This paper is reprinted from the Chinese Recorder, June, 1885.

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59.—THE SARDINE CANNING INDUSTRY OF EASTPORT, ME.

By N. H. KEMP, and others.

[A petition to the Secretary of the Treasury.]

Whereas by the expiration of the Washington Treaty of 1873 on the 1st day of July next, an important industry, which has originated since its ratification, and which is purely local to this border town of Eastport and the adjacent town of Lubec in the State of Maine; and whereas by such termination of treaty with the Canadian Government this said industry, which is the packing and canning of American sardines, is threatened with utter annihilation, we, the undersigned owners of factories at Eastport and Lubec, Me., respectfully beg to represent as follows:

(1) The industry of packing American sardines originated in this town of Eastport ten years ago, and there is invested in it at the present time capital of not less than one million of dollars, of which a large proportion is in factory buildings, machinery, fixtures, tools, and implements.

(2) There are eighteen factories in Eastport and four in Lubec, now wholly engaged in and dependent on this industry, and employing several thousand operators, partly former residents of these said towns, and partly people from other parts, drawn hither by the necessity of the factories for help.

(3) Many of these people have settled here and acquired real estate, trusting in the permanency of the industry.

(4) The towns of Eastport and Lubec have no resources for business except fish, the canning of American sardines forming the most prominent feature of their occupation. Of the fish used they receive fully two-thirds from provincial waters, being situated on the border.

(5) The fish used in this industry are small herring which have no other commercial value. Before the era of this industry they were applied to fertilizing purposes only.

(6) The provincial waters in the vicinity of these said towns abound in them and furnish an inexhaustible supply of the kind required in the sardine business, while, owing to local conditions, but a small proportion is obtainable from American waters.

(7) The fish are brought in fresh, and owing to their delicacy are of such perishable nature that they must be put through the process of canning without delay.

(8) The fish are in best condition from July until December, and are

prepared after the manner of French sardines, affording a palatable, cheap, and wholesome food product, in great demand throughout the United States and an article of export to Europe.

(9) It is therefore at the opening of the season for canning fish when the said treaty terminates.

(10) A large and valuable amount of material is used in this industry, which greatly benefits other business in and out of the State of Maine.

Now, if from any cause this well-established and generous business should fail, it would be an irreparable loss to the undersigned and their employees, to these towns and other sections of the country.

While our Government has at no time derived a revenue from the importation of these small herring, it has on the other hand profited indirectly and largely by this industry from duties on tin plate and pig tin, of which articles it is estimated the industry requires from $150,000 to $200,000 annually, with a steadily increasing demand.

Under the tariff which will take effect on July 1 next, and which provides a duty of 50 cents for every 100 pounds of fresh fish imported into the United States, except on fresh fish for immediate consumption, it becomes a question whether these small herring, which but for this exclusively local industry have no commercial value, shall be considered dutiable, or whether, forming as they do the base and necessity of this important and growing enterprise, an exception shall be made in its favor and for its maintenance; furthermore, as nothing will save these very perishable fish for food purposes except prompt canning, we respectfully beg to submit whether this may not be considered tantamount to immediate consumption.

In the event that a duty should be exacted on the fish in question it would grievously cripple, if not utterly annihilate, the American sardine industry, which even now is, and for a year past has been, suffering from the general depression of business. Compared with the cheapness of these fish, the specific duty of 50 cents per 100 pounds is exorbitant to the last degree, being far in excess of the ordinary cost of the fish. But a duty of 50 cents per 100 pounds imposed on the gross weight means to the factories a duty of 66⅔ cents on the net weight, for in trimming the fish for use a loss in weight of not less than 33⅓ per cent is experienced.

The market value of American sardines having been established and regulated by the cost of the fish, this charge would inevitably result in driving American sardines from our own and foreign markets, in favor of foreign industries, and would entail heavy losses to factory owners, and inflict untold misery on a large number and worthy class of American citizens.

Now, therefore, in consideration of the facts stated above and in view of the imminent danger which threatens these communities, your petitioners earnestly pray that you will instruct the collector of this port

to permit the importation of the designated fish, for the purpose stated, free of duty, and that you will give this matter attention at your earliest convenience, considering that but a few weeks intervene now, and if not passed upon before the 1st of July, it will seriously affect the interests and welfare of these communities.

EASTPORT, ME., *May* 28, 1885.

60.—YOUNG TROUT DESTROYED BY MOSQUITOES.

By C. H. MURRAY.

[From a letter to Prof. S. F. Baird.]

In the middle or latter part of June, 1882, I was prospecting on the head-waters of the Tumichie Creek, in the Gunnison Valley, Colorado. About 9 o'clock in the morning I sat down in the shade of some willows that skirted a clear but shallow place in the creek. In a quiet part of the water where their movements were readily discernible, were some fresh-hatched brook or mountain trout, and circling about over the water was a small swarm of mosquitoes. The trout were very young, still having the pellucid sack puffing out from the region of the gills, with the rest of the body almost transparent when they would swim into a portion of the water that was lighted up by direct sunshine. Every few minutes these baby trout—for what purpose I do not know, unless to get the benefit of more air—would come to the surface of the water, so that the top of the head was level with the surface of the water. When this was the case a mosquito would light down and immediately transfix the trout by inserting its proboscis, or bill, into the brain of the fish, which seemed incapable of escaping. The mosquito would hold its victim steady until it had extracted all the life juices, and when this was accomplished, and it would fly away, the dead trout would turn over on its back and float down the stream. I was so interested in this before unheard-of destruction of fish that I watched the depredations of these mosquitoes for more than half an hour, and in that time over twenty trout were sucked dry and their lifeless bodies sent floating away with the current. It was the only occasion when I was ever witness to the fact, and I have been unable by inquiry to ascertain if others have observed a similar destruction of fish. I am sure the fish were trout, as the locality was quite near the snow line, and the water was very cold, and no other fish were in the stream at that altitude. From this observation I am satisfied that great numbers of trout, and perhaps infant fish of other varieties in clear waters, must come to their death in this way; and if the fact has not been heretofore recorded it is important to those interested in fish-culture.

DENVER, COLO., *July* 22, 1885.

61.—AMERICAN FISH BEING ACCLIMATIZED IN FRANCE.

By C. RAVERET-WATTEL.

[From his annual report on the doings of the French National Acclimatization Society in 1883.*]

Two valuable species of American fish are in process of acclimatization in France. One is the *Salmo fontinalis*, which is now increasing rapidly; the other is the *Salmo quinnat* (California salmon), a species that is also increasing and that has been found in many of our watercourses. Thanks to the kindness of Prof. Spencer F. Baird, it has been possible for us also to continue during the past year certain interesting experiments in acclimating other species. Indeed we are indebted to Professor Baird for generous shipments of the eggs of three fish, whose acquisition in our inland waters would be very advantageous. These are the American Great Lake trout (*Salmo namaycush*), whitefish (*Coregonus albus*), and lake salmon (*Salmo salar* var. *sebago*). The *Salmo namaycush* is a trout of very rapid growth, as has already been stated; the *Coregonus albus*, with its delicate and firm flesh, could advantageously take a place beside the *fera* and the lavaret; and the lake salmon or landlocked salmon, as it is called in the United States, which is a non-migratory fish, would especially suit for stocking our inland waters; and perhaps even it could be used for restocking rivers obstructed by dams unprovided with fish-ways. In spite of the length of the voyage the different lots of eggs reached us in the best possible condition, which good result must be attributed largely to the excellent care bestowed upon the shipments by Mr. Fred Mather, who was kind enough to attend to packing the eggs.

While these shipments of fish eggs put us under new obligations to Professor Baird, other gifts were generously made us by the German Fishery Association. The president of this association, Von Behr, forwarded to us some eggs of different species of salmon, such as the grayling (*Salmo salvelinus*), the Lake Garde trout, known under the name of *carpione* (*Salmo carpio*), and two species of whitefish (*Coregonus maræna* and *C. albula*), which must be classed among the best food-fish.

A medal of the second class was granted to Professor Valery-Mayet, of the National School of Agriculture at Montpellier, who has given us most useful co-operation in spreading and popularizing American salmon. These fish from the New World are more appreciated every year, and, thanks to Professor Valery-Mayet, are now found in the Mediterranean.†

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* *Bull. Mens. de la Soc. Nat. d'Acclimatation de France*, May, 1884, pp. 117 and 134.

† For report on salmon caught in the rivers Aude and Hérault, see Prof. Valery-Mayet's statement on page 260 of this volume.—EDITOR.

62.—THE FISHERIES OF PENSACOLA, FLA.

By SILAS STEARNS.

The fisheries at this point have not been so successful and lucrative as usual during the season that is just ending, mainly on account of the boisterous weather that prevailed.

In the red-snapper fishery it was expected at the beginning of the season that there would be a great improvement in the catch and in the regularity of supply, because of the introduction into the business of larger vessels, better crews of fishermen, and some improved methods of capture. But while the well-equipped vessels proved admirably adapted to the work, the supply of fish was but little better than that of former seasons. This circumstance is due to the fact that the red snapper is becoming less abundant and is being taken at greater distances from the market, and that during the very windy weather fishing or searching for the fishing grounds is impracticable.

In addition to the old fleet of red-snapper catchers, there were three well-fitted vessels, carrying crews of 10 or 12 men each, that were made up at Portland and Gloucester, and who were believed to be experts in their profession. There was also employed the schooner Henrietta Frances, of Boston, a 75-ton mackerel catcher, with a Portland crew of 18 men. One of these vessels, in charge of Capt. D. E. Collins, of Gloucester, had an outfit of trawls, such as are used at Gloucester and Portland for haddock; but these trawls, after several thorough trials, were laid aside for the old hand-line gear, as they did not prove to be so effective.

The experience of this winter, even with its bad weather, has not enabled the fishermen to determine whether an outfit so expensive as that of the Henrietta Frances will be profitable, owing to the fact that there were but few times during the season when she went to sea that the small vessels of 30 and 40 tons did not go, and even on the fishing grounds the smaller vessels would be at work quite as long. There is, however, an advantage in such a vessel, in her ability to make longer and quicker passages, and in having plenty of room for the storage of ice, which will receive greater consideration as the fishing grounds are found farther from the home market.

During this season the vessels of 35, 40, and 50 tons have been the most profitable, especially those without "wells." The smaller "well" smacks made small and infrequent catches through the winter, and the market would have been bare much more than it was had the dependence been wholly upon them.

The following figures show the gross stock of several of the vessels for the winter: Henrietta Frances, of 75 tons, $3,200; John Pew, of 42 tons, $5,811; H. S. Rowe, of 56 tons, $3,000; Sarah L. Harding, of 30

tons, $2,927; Clarence Barclay, of 25 tons, $2,000. The expense of landing that value of fish was so great that there was practically nothing left for the share of the vessels. The crews are generally hired by the month, the captain, however, receiving a share. The ordinary fisherman receives $25 per month; the cook, $30; and the mate, who stows the ice and fish and is general leader of all work, $40. The crew of the Henrietta Frances, who were on shares, after the Portland fashion, realized about $25 per month for the season.

As an instance of the uncertainty of success attending this fishery I will state that several skippers, who are usually very successful on the New England coast, have made frequent failures here, while exerting themselves to the utmost to prevent it. In this climate a fishing trip cannot be prolonged as it can be farther north, because the supply of ice is soon melted, or else the fish will be unsalable when landed.

The unusually cold spring delayed the run of shore fish, as pompano, Spanish mackerel, bluefish, &c., fully a month. They appear generally by the first of March, while this season they did not come until the first of April, when the best demand for them was over.

The Spanish mackerel was the kind first caught this year, and they seemed to come on the coast at all points simultaneously. Boat after boat came to the market loaded, the crews reporting that they could have taken all that they wanted. The light demand was soon supplied and a good many fish were thrown away, either at Pensacola or at the interior cities whither they had been shipped. It was at this time that the spring flood of lake fish came into the western markets, crowding out Gulf fish by their cheapness. When the demand for Spanish mackerel became so light, the Pensacola fishermen stopped catching more than could be used in the city. During the month of April they have been extremely abundant along the coast; and are now, at the first of May, just entering the bay. This run of mackerel is of a larger size than is remembered as having occurred before in ten years. It is usual for them to appear in schools at the water's surface off shore as early as the middle of February or the first of March, and then in March and the first of April to straggle along the sea-beach in pursuit of "bait," as they are moving toward the bays. There have been seasons when the mackerel would be abundant off in deep water, and but very few would be seen or taken in seines along the shore. This year they seem to be mainly in shoal water and in greater numbers than ever before known here.

Pompanos have not been as abundant as usual. A great many were taken farther south, in the vicinity of Tampa, and shipped from Cedar Keys. These were placed on the market earlier than the fish arrive at the Pensacola section, and while the demand for fish was good. At the beginning of the pompano run here, a car load of them was shipped from Cedar Keys to New Orleans, where they were sold cheaper than the Pensacola fishermen expected to receive for their catch. So far, the

Pensacola fishermen have caught all the pompanos that they could and have sold them readily, although at a low price. It is probable that there will be a good many taken in May, and as they become less abundant elsewhere the prices will be better.

Bluefish did not appear until the last of April, and none have been seen in a large body. They are caught in company with Spanish mackerel in small lots. The bunches are small in number and the fish small in size. It is strange that there are so few large bluefish on this coast similar to those found on the Atlantic coast. Bluefish will likely be caught all summer in considerable quantities, although the fishermen do not expect as good a run as usual.

The following figures are given to show the difference in the catch of these shore fishes of the past two seasons, from the first run to the 1st of May. In 1884, the season began the 1st of March, and in 1885 it began the 1st of April. Pompano, 1884, 10,632 fish; 1885, 6,988 fish. Spanish mackerel, 1884, 33,212 pounds; 1885, 121,931 pounds. Bluefish, 1884, 39,580 pounds; 1885, 6,000 pounds. The prices of 1885 have averaged one-third less than those of 1884.

PENSACOLA, FLA., *May* 1, 1885.

63.—PROPOSED TRANSMISSION OF SALMON EGGS TO CHILI AND IMPORTATION OF CHILIAN SPECIES OF FISHES.

By JUAN DE LA C. CERDA.

On sending the salmon spawn to Chili it will necessarily have to be under the charge of some competent person, who must not only know how to overcome the difficulties the voyage presents, but also to superintend their hatching in Chili and the preparation of the fish at the first period before letting them loose in the rivers.

In a word, what we want to realize in Chili is the establishment of one or more hatching houses, taking as a model those of the United States, not only for the introduction of salmon, carp, and other foreign fish, but likewise the study of ours, of which up to the present very little is known, since no one has taken the trouble to study them from an industrial point of view.

In order to carry out the wishes of my government to make a contract with the person who is to take the salmon and fit up the hatching houses, I have seen several persons in this city who have been recommended to me as competent in this branch. Up to the present, however, I have not entered into any arrangement with any of these gentlemen, as the epoch for realizing this enterprise is still distant, being in the months of September and October; nevertheless, the necessary preparations must be made in August.

From what I know of some of the rivers in California, as the Sacramento, San Joaquin and its affluents, I can assure you that it would

be easy to stock the rivers in Chili with salmon, as they are as suitable as the rivers in this country. The temperature of the Chilian rivers is generally from 40° to 50° F., and, with the exception of one or two, all the rest, which exceed fifty, are of clear water, of gentle current, and some of them have their origin in lakes of great extent, such as Llanquihue, of 740, and Nahuelguapi, of 1,260 square kilometers.

The fish of Chili worthy of being studied and brought to this country are the following:

The Lisa (*Mugil chilensis*) is a fresh and salt water fish, resembles the common mullet, is about 3 feet long, and its body is oval-shaped, covered with fine silvery scales, which give it a smooth aspect, hence the origin of its name. Some of them weigh as much as 20 pounds. Its flesh is white, tender, and juicy, and of so delicate a taste that I venture to assert that neither in this country nor in Europe have I ever eaten any other superior to it. It is found in few places in Chili, the principal being a small lake found on the Convento estate, about 85 miles from Valparaiso, and about the same distance from Santiago, formed by the river Yaly at its entrance into the Pacific Ocean. The waters of this lake are perfectly sweet in winter, and very brackish in summer, and yet this fish lives in both seasons, as is proved from its being caught all the year round. I am not acquainted with any details respecting its reproduction and habits; for that reason I think it would be worthy of study on account of the importance of its flesh.

Another fish of importance which lives exclusively in fresh water is the Pejerey (*Cyprinus regius*), or kingfish. Its ordinary length is about 1 foot, and its weight from 1 to 2 pounds. It has fine and silvery scales, like that of the Lisa, and its flesh is fine and delicate. This fish is found in almost all the Chilian rivers and lakes, but where it thrives best is in the lake of Aculco, about 40 miles to the south of Santiago. There some are caught a foot and a half long, and more than 3 pounds in weight.

Among the sea fish the Robalo (*Esox chilensis*) is notable; its flesh is excellent, and it is found along the Southern Pacific coast as far as Cape Horn. In some parts, as in Chiloe, it is found in such abundance that the inhabitants of the coast dry and smoke it, and in this way they carry on a very fair trade; its length exceeds 3 feet.

Another important sea fish is the Corvina (*Sparus chilensis*), which usually reaches 6 feet in length, and is esteemed for its excellent flesh.

Among shell-fish the Choro (*Mytilus chorus*) is worthy of note. It inhabits the submarine rocks of the Island of Quiriquina, opposite to the port of Talcahuano. The length of its shell is generally about 7 inches, and its breadth 3½; its flesh is of a yellowish white color, very savory and much esteemed in the country.

Scientific details respecting these fish and shell-fish are probably to be found in the Natural History of Chili, by C. Gay.

CONSULATE-GENERAL OF CHILI,
San Francisco, Cal., May 9, 1885.

64.—CARP CULTURE IN CHINA.*

By E. J. SMITHERS.

[Dispatch No. 125 to the State Department.]

The cultivation of carp from the spawn in this province appears to be unknown. This may be attributed to the great abundance of this description of fish to be found in the Yangtse and in the numerous canals which intersect the province.

Very small carp are preserved alive by the fishermen and sold in the markets to the farmers, who place them in their irrigating ponds, where they are fed until large enough for use. In the adjoining province of Anhui and in that of Kiangsi the collection of spawn in the waters of the Yangtse has been carried on from time immemorial, and forms at the present time a very large industry. Hundreds of small boats arrive in the Yangtse during the month of April, coming from the Poyang Lake and its many tributaries. The spawn is collected in spawn nets, which are made by suspending very fine cloth from two bamboo poles which are fastened together in the shape of the letter V. At the point of the net a basket about a foot square is suspended so as to catch the spawn which find their way into the net. These baskets are emptied several times during the day into large water-jars, where the spawn is kept until the boat is ready to leave with its cargo, the eggs which float near the surface are considered inferior and are separated from the rest. The Chinese say that the carp's eggs are the heaviest and consequently settle on the bottom of the jars. The water in these jars is frequently changed during the day and the spawn nourished on gruel made from the upland or glutinous rice. When sufficient spawn is collected they are placed in small earthen jars or bamboo baskets, which are deposited on shelves arranged in tiers around the boat. Each boat contains about two hundred jars.

At the end of June the boats start for the upper waters of the Poyang Lake and other tributaries of the Yangtse. During the voyage the water in the jars is frequently changed and the spawn fed on gruel. At different points on the route the natives congregate to purchase the spawn, which is sold to them by the measure. When the boats arrive at their destination the remainder of the spawn, which has now reached a considerable stage of development, is placed in feeding

*In the latter part of 1884 Mr. John Russell Young, the minister to China, requested the several United States consuls to report to the legation on the subject of carp culture in that Empire. With the exception of three consuls, whose statements are here printed, they reported that carp culture was not practiced in their districts. These three statements have been transmitted to the Fish Commission by the courtesy of the Secretary of State.

ponds. Here they are fed on gruel and the refuse obtained after extracting the oil from rape-seed. As soon as the spawn are large enough to determine their species they are separated and the different varieties placed in ponds by themselves.

From these ponds they are sold to the natives, who come from distant parts of the country where there is a scarcity of fish. They carry them to their homes and place them in artificial ponds, each household having at least one, where they are fed on pigs' blood, and, as they grow large, upon worms, small frogs, &c. The carp is the most valued by the Chinese for cultivation, because it is more easily transported from place to place, and is the most profitable on account of its food properties. It is said that if properly cared for they will weigh 4 pounds the first year and attain their full growth in five years, when they will weigh from 25 to 30 pounds.

UNITED STATES CONSULATE,
Chinkiang, Kiang-Su, January 31, 1885.

65.—FISH-CULTURE IN CHINA.

By ISAAC F. SHEPHARD.

[Dispatch No. 111 to the State Department.]

In accordance with the request of Minister Young, I have investigated the subject of fish-culture in my consular district, and regret that I can obtain only very meager results. I have consulted natives and foreigners alike, and have, through an interpreter, sought for and examined books that treat of the topic. These last give no details and no statistics, only referring to the fact that fish are cultivated by artificial means, for the purpose of securing food for the populace. From the varied sources it is shown that fish-culture is extensively pursued in this region, by gathering the seed from the Yangtse River, and transferring it to the numerous inland lakes that abound. Many of these are permanent bodies of water, and many others are formed by the periodic overflow of the large river which inundates the country in all directions for many miles. These lakes are all stocked from the Yangtse, and the business of taking the seed-fish, transporting to the cultivating waters, feeding and recapturing for market or use is one of great extent, although no statistics are available by which to estimate it.

The seed taken is not the spawn of the fish, but infinitesimally small fish themselves. These are caught by sinking nets along the shores of the Yangtse, and when captured are transferred to tanks attached to fish-boats, and thence to larger receptacles, usually large water kongs. The nets used are of extreme fineness, so that scarcely perceptible fish cannot escape through the meshes. They are fed on hard boiled yelks of eggs, wheat, bran, and bean flour, and on this food they flourish and

develop rapidly. The time of taking seed is in the months of May and June, when the shores of the river for miles are besieged by fishermen. The water nearest the shores abounds in the hatching spawn, and overhanging banks, quiet nooks, and still waters seem to be favorite breeding places, where development is safe and rapid. I am not certain whether the spawn is originally deposited in these spots, or whether it is floated down from lakes having their outlet in the river. Both theories are strenuously held by the natives, and with the preponderance of opinion in favor of Toong-Ting Lake as the depository, where the fish certainly abound.

TRANSPORTING THE SEED.—The young fish once gathered in the kongs are at once for sale to the inland breeders, who buy in quantities varying according to demand. A few cash will purchase a bucket full of the scarcely perceptible finny infants, and, swung to each end of a coolie's yoke, is borne to the breeding pond in the interior. I learn of such transportation for 300 miles inland from Hankow, and as long distances north and south. The ponds in the rear of Shanghai are supplied with seed-fish from this locality. Such facts indicate the vast importance of artificial fish-culture in China, but I can learn of no statistics bearing upon the topic, nor can I compass any means of securing them.

The varieties of fish thus cultured do not seem to be a matter of moment to the natives. They do not appear to discriminate between the kinds of piscatorial denizens of the river, but literally "all is fish that comes to their nets." Nor am I certain that the carp proper is one of the breeds cultivated, as I do not know that fish, and have failed to learn from extensive inquiry of its being found here. There is a fish constantly in the market, however, which greatly resembles the descriptions of the carp, and is analogous to it, if not the true carp. It is reared in great abundance in the lakes, as before described, and extensively used; it is large enough to be taken after a period of seven months from the spawn, but grows more than double that size and weight by longer keeping. They are fed very little after once being transferred to the lake.

OTHER FISH.—Several other varieties of fish are caught at the same time and reared in the like manner. Among them are the "mandarin fish" and the "perch." The former is much more delicate as a table fish, but much smaller than the supposed carp.

It is sometimes asserted that the fish-culture is under government control and regulation, but I do not find such to be an established fact. I have inquired of fishermen, who know nothing of it; and I apprehend that the impression has grown up from the fact that fishermen have used small flags indicating their special pursuit, and these have been mistaken for government announcements.

UNITED STATES CONSULATE,
Hankow, Hoo-Pe, January 3, 1885.

66.—FISH-CULTURE IN SOUTHERN CHINA.

By CHARLES SEYMOUR.

[Dispatch No. 96 to the State Department.]

It must be borne in mind that the Chinese are not communicative in respect to any matter of business in which they are interested, and will not knowingly impart any information that may, in the slightest degree, be utilized by foreigners, or tend to induce or cause rivalry. In gleaning this information I have had assistance from a foreign gentleman, who has held official relations to the Chinese during a residence of about a quarter of a century in China, and has had access to sources of knowledge regarding the various industries of this country to which a comparative stranger could not reach. Through him I have reached many facts.

In an old and populous country like China, the supply of food is a question that demands serious attention, especially when the subsistence of a human adult has to be restricted, among the masses, to a cost of about $2 per month, or about 6 or 7 cents per day. Rice in China is the staple article of food, as wheat and corn head the list in America. Vegetables take the second place in the Chinese cuisine. Fish stands next in the list of Chinese eatables; and although the poor and laboring masses are mainly restricted to rice and vegetables for diet, enormous quantities of fish are consumed; and to supply the demand for fish there are in all the villages, and in the suburbs of the cities, pools for fish-culture, and from these pools fish are scooped out to supply the markets and peddlers, for sale to and distribution among consumers, who never buy a fresh fish out of water.

Enormous tubs containing water are daily filled with live fish that are brought direct from the fish-pools in fish-boats, into and through which by constant pumping fresh water is carried; and those huge fish-tubs carry thousands of fish to the Hong-Kong fishmarkets, by means of the daily steamers.

At all fish-stands in Canton and in the surrounding country fish are thus sold alive, and the consumer makes his own choice. If a purchaser wants only a portion of a fish, he is accommodated by having one side of a fish cut off without getting any bone with the meat, and as soon as a buyer is found for the other side of the fish the skeleton of the fish is hung up to attract buyers who want a fish-soup or chowder. In this way small buyers are enabled to get portions of fish weighing from 2 to 10 pounds, and thus indulge themselves in a dish that cannot be obtained every day by the poorest class.

Fish, then, is in demand everywhere, and no one among the natives seems to be indifferent to this article of food, although it must be

stated that few foreigners ever put freshwater fish on their tables, for reasons which will appear when it is known by what process Chinese fish-culture is carried on.

CARP CULTURE.—The carp is successfully cultivated, and nearly all of the fish-pools in this and surrounding cities, villages, and towns are supplied from one and the same fish-hatchery.

The locality where this great fish-hatchery has long flourished is known as Kow-Kong, in Kun-Chuk district, in the province of Quang-Tung, where fish-culture from the spawn, up to a suitable size for transfer to fish-pools in all parts of the country, has been carried on for many centuries, without any rival locality becoming a successful competitor. The business is conducted so exclusively and carefully that outsiders are not very minutely informed as to the exact process.

The chief peculiarities of the locality known as Kow-Kong are that it is in the heart of the silk district of Southern China, and at a part of the West River (or western branch of the Canton River), full of alluvial deposit, undisturbed by boats, with about 12 feet depth of water on that reach, where the river is about half a mile in width and the shore or bank beautifully shaded by trees, and about 90 miles from the sea, and subject to moderate tidal changes.

It is believed, and doubtless it is true, that the refuse silk-worms from the silk-growing district attract fish to that point for food; and that the even temperature of the water and its exemption from disturbance, together with the rich deposit of alluvium, and the shadiness of the locality, have given that Kow-Kong reach on the West River peculiar advantages as a spawning ground for fish.

The spawning season generally occurs during the third and fourth moons of the Chinese year, which begins within a week or ten days of the western 1st of February.

The rainy season in Southern China usually begins about the 1st of March and sometimes by the middle of February.

The third and fourth months, or moons, of China would correspond nearly with our months of April and May, or toward the latter part or after the middle of the rainy season, extending through three or four moons. The fish spawn is then most plentiful. The waters being more or less muddy and thick at that time the spawn cannot be seen in it, and to ascertain if the spawn has arrived the fishermen have recourse to weighing a certain quantity of water, which is increased in weight by from 2 to 4 ounces of spawn if the spawning has commenced, according to an experienced fisherman's estimate. The spawn is caught only on the flood tide in closely woven bags with wide mouths. The insides of the bags are coated with a paste made from the white of eggs and flour, which is often renewed as it washes away. To this paste the spawn adheres. The mouths of the bags are then somewhat closed and kept above water while the lower parts of the bags are kept under water with the spawn, and after a couple of days they are removed

from the river to fish-pools or ponds which are about 20 feet square and are fed by tidal creeks from the river, flood-tide water being preferred.

After about six days the eggs have germinated into small fish. During this hatching process a covering of tree branches is put over the pond, about 4 feet above the water, to screen the pond from excessive light and heat and from the influences of capricious weather. When the fish are about 1 inch long they are sold to stock fish-ponds in various localities where fishermen are raising fish for markets.

Now comes the filthy process of feeding fish which prevails in Southern China. The fish ponds are located at every city and village on tidal rivers, streams, and creeks, and at the corner of each of these fish ponds is an accumulation of human excrement, which (after undergoing water-rinsing twice to extract urinal properties) is mixed with finely-cut young grass and fed to the fish. On this food and the tidal water they thrive and have no other nutriment.

The climatic conditions of a locality for fish-culture are worthy of consideration. The temperature of this portion of Southern China ranges during the year from 38° to 98° Fahrenheit in the shade, there being only a few days, perhaps a week, of these extremes. The temperature during the spring months of April and May ranges from 70° to 90°, the average being from 80° to 85°. Ice seldom forms. Once perhaps in half a dozen years frost makes a morning appearance, but quickly vanishes.

If further investigations of carp culture or fish-culture in Southern China are desired I can cause a thorough examination of this subject, but it is impossible to obtain more definite information without employing good men to go and visit the fish-hatchery district, and even then every statement has to be tested by facts from various sources.

It is possible that in the archives of the French legation, at Peking, there may be the results of a very thorough investigation into the industries of China by a corps of experts, who were attached to that legation when France was represented in China by a minister named Le Grene, about 1844. Among those experts who were employed in that work were gentlemen who were known to be very competent in their respective departments. Possibly fish-culture received due attention, as did silk and other branches of industry.

UNITED STATES CONSULATE,
Canton, Quang-Tung, December 26, 1884.

67.—NOTES ON THE HABITS OF THE GOLDEN IDE (IDUS AURATUS).

By RUD. HESSEL.

The golden ide (*Idus auratus*) likes a cool, clear water. Notwithstanding, it can be kept in ponds where the water reaches a higher temperature—from 70° to 80°. In clear, cool water, such as spring water, they will obtain a more brilliant color than in muddy water.

The *Idus* has the habits of a river fish, likes deep better than shallow water. It seeks under plants and stones such food as larvæ, worms, and snails. It takes almost the same food the carp takes, including bread, cooked cornmeal, &c. Vegetable food it will not take.

The golden ide should not be kept in the same pond with carp. The carp make the water muddy and the ides destroy the ova of the carp. Carp should never be kept in an ide pond if it is desired that such ponds should be clear and that the ides should show to a good advantage.

The golden ide spawns in the neighborhood of Washington in April and the beginning of May, and in cool ponds (spring water) at the end of May. In the Southern States they spawn by the middle of March.

In regard to hatching in ponds, they would do better in large and deep ponds, with a good crowded vegetation, than in small or shallow ponds. The water in such smaller ponds, during cool nights, often attains a low temperature, which would prevent the ova from hatching out advantageously.

WASHINGTON, D. C., *June* 1, 1885.

68.—FISH-CULTURE AT GOUVILLE, FRANCE.

By LEON D'HÂLLOY.

[From a letter to C. Raveret-Wattel.*]

Eighteen months ago we placed in the lake at Gouville 1,400 trout a year and a half old. The year before we had placed there 6,000 about six months old. Of these last not one has been recovered, as they were probably too small to defend themselves in that body of water (about 11 acres). This year we have caught 1,016 three-year-old trout, resembling those we put in. These trout sold in the market for an average of 2 francs [38 cents] apiece. Our *fontinalis* have grown less rapidly than either the Scotch or the lake trout; we are now placing in the lake some two-year-old trout. The Rocky Mountain trout from California is a splended variety. Following your advice, I have imported eggs for two years; and this year I have again had 20,000 which hatched well, although there was a considerable loss owing to the long voyage. We have now some good breeders; and during this year we have obtained 40,000 eggs, while next year (1884–'85) I hope to get 100,000. I think that now the question of industrial fish-culture is settled, or at least, is on the point of being settled. Our expenses are as follows: One man, 1,200 francs; food for the trout, 300 francs; total, 1,500 francs a year (and we have never spent more). The lake fishing would have returned 2,000 francs if we had not reserved some breeders, and the different

* From Bulletin of French Acclimatization Society, July, 1884, p. 600.

fisheries in the river would give us at least 1,500 francs a year; total, 3,500 francs. This year we intend to place 2,500 two-year-old trout in the lake, which will greatly increase the fishing; and I hope that here in a few years we shall put in the lake 5,000 or 6,000 a year, for I think it can hold 20,000. We have much less mortality among the fry coming from eggs obtained at Gouville than from those bought elsewhere, for while the journey does not prevent hatching, it renders the fry more delicate. I forgot to say to you that the trout in the lake have not received special food for eighteen months, but have lived on insects, minnows, &c. This year we have had, including the foreign eggs, 100,000 fish hatched.

69.—FISHING ON AN EDGE OF THE GRAND BANKS.

By Capt. J. W. COLLINS.

[From a letter to Prof. S. F. Baird.]

Capt. George A. Johnson, master of schooner Augusta H. Johnson, who has just returned from a fresh-halibut trip to the Grand Banks, tells me that he fished around the edges of the deep-water pocket on the eastern side of the banks (in north latitude 44° 3′), which he reported some time ago to the Hydrographic Office at Washington.

A remarkable feature of the fishing in that region is the great abundance of ground-sharks. So plentiful were these that Captain Johnson could not leave his trawl-lines out over night, since, if he did, the sharks would get on the hooks and destroy the gear by rolling up in the lines, breaking them, &c. On one occasion his men caught and killed 46 sharks in one day, one dory getting 18 of them on its trawl. Many of these sharks were of extraordinary size, the men reporting them to be much longer than their dories. As a dory is more than 19 feet long over all, this method of measuring would make some of the sharks from 20 to 25 feet in length. This species of shark is noted for its sluggishness, and it is not uncommon for large specimens to be hauled up on trawl-lines, though I have never before known of its occurrence in such numbers as reported by Captain Johnson.

In the deepest part of this pocket the bottom is muddy. Grenadiers (*Macrurus*) are abundant, and some very large specimens of Newfoundland turbot (*Platysomatichthys hippoglossoides*) were taken. The latter weighed more than 20 pounds on an average, as Captain Johnson thinks, which is an extraordinary size. They generally do not average more than from 5 to 10 pounds. Several icebergs were grounded in the pocket. One, which lay about 3 miles inside the pocket's mouth, was grounded on the northern side in 125 fathoms, as Captain Johnson ascertained by sounding near it.

GLOUCESTER, MASS., *July* 20, 1885.

Vol. V, No. 17. Washington, D. C. Aug. 18, 1885.

70.—REPORT ON PLANTING CANADIAN OYSTERS NEAR THE ISLAND OF AARÖE, IN THE LITTLE BELT, NOVEMBER 6, 1884.*

By Prof. KARL MÖBIUS.

On the 17th of April, 1883, at a public meeting of the German Fishery Association, I read a paper on the transplanting of oysters, which induced the board of directors to order some American oysters from the northernmost points where they are found; and, if possible, they were to be from beds situated in the mouths of rivers, where the oysters had been accustomed to water of less saltness than on the coasts of the open sea. Instruments for testing the saltness of these waters were, during the summer of 1883, sent to the Canadian Government by G. von Bunsen, of Kiel, second director of the association. Various reports on the physical conditions under which the Canadian oysters live were received from Canadian officials, and further aid was promised, so that we could hope, through the assistance of Canadian fishery officials, to obtain the desired kind of oysters for our important experiment.

About this time Carl Rumpff, member of the chamber of deputies of the Prussian Parliament, was informed of the plans of the Fishery Association, and offered to use his knowledge of North America, and his American business connections in furthering these plans. In reply to inquiries, persons who possessed a thorough knowledge of the Canadian oyster fisheries suggested that the oysters be sent to Europe not in spring, but late in autumn, when an evenly cool temperature might be looked for. We therefore looked for their arrival in October or November, 1884. We were notified of their shipment by telegram, and on November 3, 17 barrels of oysters arrived at Bremerhaven by the Bremen steamer Werra. Mr. Rumpff was there in person to receive them, and on November 5 brought them to Hadersleben, by way of Hamburg.

As Mr. Rumpff had advised me by telegram that he had started with the oysters, I met him at Neumünster at 4 p. m. on November 5. At 7 p. m. we passed Flensburg, where we were joined by Mr. Hinkelmann, superintendent of fisheries of the district in which the oysters were to be planted. At 10 p. m. we reached Hadersleben, where we were met by A. Jensen, who was to forward the oysters to their destination. By the kind assistance of railway and custom-house officials he succeeded in transferring the 17 barrels of oysters, by 8 a. m. of November 6, to the steamer for Aaröesund, where we soon joined him.

* "*Bericht über die Auslegung kanadischer Austern bei der Insel Aarö, im Kleinen Belt, am 6. November* 1884." From Circular No. 8, 1884, of the German Fishery Association, Berlin, December 2, 1884. Translated from the German by HERMAN JACOBSON.

When all the barrels had been placed on the deck of the small steamer we had one of them opened, and were rejoiced to find only a few dead oysters on the top; the lower layers were all firmly closed and emitted no odor. Although removed from their native element, they had successfully stood a journey of almost twenty days, and there was every prospect that when again placed in the sea they would thrive. After a sail of two hours we reached Aaröesund, where fishermen well acquainted with the locality, aided by the crew of the revenue-cutter stationed at Aaröesund, took the oysters to those places where they were to be planted under our directions. The weather was favorable. We first selected a place southeast of Aaröe, where the bottom was tolerably firm and with only a few aquatic plants here and there. Before planting 11 barrels of oysters, a boat-load of broken bricks and tiles was dumped into the water, in order to provide suitable objects to which the young oysters might adhere. The other 6 barrels were planted northwest of Aaröe, near the coast of Sleswick.

With the purpose of ascertaining the entire number of oysters, we had the contents of one barrel counted. It contained 800 oysters, and we have therefore planted about 13,000. While the oysters were being thrown into the water the ship was placed at anchor, but from time to time a little more of the chain was paid out, so that we slowly moved a little towards the east-northeast. We had a map of the Little Belt, and the places where we planted the oysters were properly marked, so that they can be found at any time without difficulty. None of the places where our Canadian oysters were planted were the same where Engineer Meyer in 1880 planted smaller American oysters.

As one barrel after the other was opened and emptied we were rejoiced to find that at most only 5 per cent. of the oysters were dead. Those which were alive kept their shells as firmly closed as if they had been taken from the water only a few days before. Some which were opened were found to be entirely free from any disagreeable flavor and tasted as fresh as if they had left the bed very recently. The North American oysters which I tasted at the Fishery Exhibitions of Berlin and London did not have as fine a flavor as these Canadian oysters. They had not been washed before packing, for their shells were covered with yellow mud. Besides this mud from the oyster-beds there were found in the barrels many shells of *Crepidula fornicata* L., a snail which is frequently found on the oysters of the Gulf of Saint Lawrence, as stated by A. A. Gould in his work, Invertebrates of Massachusetts, Mollusca, 2d ed., 1870, p. 202.

After we had consigned the oysters to the sea, and requested the crew of the revenue-cutter to see to it that they were not disturbed, we returned to Hadersleben in the afternoon, and in the evening had a conference with several persons who had aided us or were to aid us in the future. Early on November 7 we left Hadersleben, happy in the thought that the second attempt to plant North American oysters on

the east coast of Sleswick had been made on a thoroughly sound basis, and that healthy oysters had been planted. We must now wait patiently and see whether these oysters will not only live for a period of years in the saltest portion of the German waters of the Baltic, but also grow, propagate, and produce a numerous offspring which will form regular beds.

If our most sanguine expectations are realized, that is, if the oysters, which undoubtedly have reached the period of sexual maturity, during the coming summer produce spawn, and if this spawn adheres to shells of the mother oysters, to tiles and bricks or other objects on the bottom of the Little Belt, and if by autumn the young oysters have reached a size such that they can easily be found, our experiment has not yet been brought to an end. The first Baltic offspring of our Canadian oysters must grow up, must reach sexual maturity, and must in turn produce offspring, and such an event can hardly be looked for before the summer of 1887 or 1888. We therefore have to wait at least three or four years before our experiment, which begins under the most favorable circumstances, will show whether the Canadian oyster will permanently thrive in the Baltic.

In conclusion I will add a few remarks as to the origin of these oysters and their transportation to Bremerhaven (the data have been kindly furnished by Mr. Rumpff), and on some of their zoological qualities.

The oysters planted by us were almost evenly divided between two varieties of the American oyster, namely, the round and the long variety, which by some conchologists are considered as two different species. The round variety is known in natural history as *Ostrea virginiana* Lister, and the long variety as *Ostrea canadensis* Brugière, or *Ostrea borealis* Lamarck. From measurements made by me it appeared that most of the shells of the round oysters (*Ostrea virginiana*) planted by us were from 80 to 100 millimeters long, from 60 to 70 millimeters broad, and from 25 to 35 millimeters thick; while most of the shells of the long variety (*Ostrea canadensis*) were from 120 to 200 millimeters long, from 50 to 70 millimeters broad, and from 20 to 37 millimeters thick. If the annual growth of the Canadian oysters progresses at the same rate as that of the Sleswick oysters, I estimate most of the oysters planted near Aaröe to be from six to twelve years old.

The long oysters had been taken from beds 18 feet deep at the mouth of the Saint Lawrence River, and the round ones at the same depth from beds in the open Gulf of Saint Lawrence. Ten barrels were filled with each of these two varieties, and by the most rapid transit, by way of Quebec and Portland, conveyed to New York, where they arrived on October 24. As the barrels were received in a somewhat damaged condition, the oysters were taken out and during the night packed by skilled persons in a better and firmer manner, so that the round oysters only filled 9 and the long ones 8 barrels. They were taken on board the Werra on October 25, and arrived in Bremerhaven on November 3.

It is owing to Mr. Rumpff that the oysters were conveyed from the mouth of the Saint Lawrence River to the Little Belt in excellent condition and in the comparatively short time of twenty days. I desire nothing more earnestly than that his disinterested efforts may be crowned with complete success, and that the Canadian oysters may thrive in the waters of the Baltic.

71.—NOTE ON THE CULTURE OF AMERICAN SALMON IN FRANCE.*

By C. RAVERET-WATTEL.

On his return from a scientific mission to Tunis, Prof. Valéry-Mayet said: "Several American salmon have during the last year been caught in the river Hérault and the river Aude, although I had not placed any in the last-mentioned river. This year some more have been caught in the river Aude, but I have not been informed of similar catches in the river Hérault. The Aude is really more favorable for the development of salmon than the Hérault. Like the river Garonne, which is so rich in salmon, it rises in the Pyrenees, and for three-fourths of its course has an oceanic climate, like the Garonne."

The secretary called attention to the transmission of eggs of the *Salmo quinnat*, the young fry of which were placed in the Hérault, where, however, none of them were found again, while some have been caught in the Aude. He thinks that it would be interesting to renew this attempt to introduce salmon in watercourses, limiting these attempts, however, to the ordinary kind (*Salmo salar*).

If the Society should share this opinion, would it not be necessary to decide at the present time what should be done when the time arrives to make this experiment? In his opinion it would be best to place the young fry not near the mouths of these rivers, as has been the practice hitherto, but rather near their sources, with the view to come nearer to the conditions of natural reproduction.

The eggs might be sent at the opportune moment for subjecting them to the process of incubation, by having an arrangement with Valéry-Mayet, professor at the Agricultural School of Montpellier, whose zealous and intelligent aid is entirely devoted to the Acclimatization Society. Prof. Valéry-Mayet should be written to now, asking him to state on what conditions he could receive an instalment of eggs with the view to their incubation and the placing of the young fry in the river Aude.

Mr. Grisard, in this connection, recalled the fact that bull-frogs which had escaped from the Acclimatization Garden had successfully propagated their species in the marshes of the Bois de Boulogne, where at this day they may be found.

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*From *Bulletin Mensuel de la Société Nationale d'Acclimatation de France*, fourth series, Vol. I, No. 9, September, 1884, pp. 758–766.

72.—DISTRIBUTION OF AMERICAN FISH AND FISH-EGGS BY THE GERMAN FISHERY ASSOCIATION.

By MAX VON DEM BORNE.

CANADIAN OYSTERS.—In Circulars 2, 1883, and 3, 1884, it is stated that hopes were entertained of successfully transplanting Canadian oysters to the Western Baltic. The necessary condition was to take the oysters from latitudes whose temperature all the year round corresponded to that of the Western Baltic, and from waters whose saltness was as nearly as possible the same as that of the Baltic. We are now glad to state that, thanks to the exceedingly careful arrangements made by Messrs. Rumpff and Möbius, the experiment of transporting these oysters across the ocean has proved a great success. The first telegram from these gentlemen, dated November 7, 1884, reads as follows: "Oysters arrived in excellent condition; upwards of 13,000 live oysters planted in the Baltic, during the most favorable weather."

The telegram was followed by a short letter from Prof. Karl Möbius, in which he promises a full report for our next circular, and states the following: "Messrs. Rumpff and Möbius, on the morning of November 6, left Hadersleben [in Sleswick-Holstein] with the 17 barrels of oysters, and conveyed them to Aaröesund, on the Little Belt. There they were placed on board the revenue-cutter, on which there were several experienced fishermen, and after a short while suitable places for planting the oysters had been found. When the barrels were opened nearly all the oysters were firmly closed (and therefore alive), and only on the top were a few dead oysters found. The flavor of the oysters was as fresh and good as if they had left their Canadian banks only a few days ago. We have carefully marked the places where the oysters were planted, so that they can easily be found."

CALIFORNIA SALMON.—The American fish-culturist Marshall McDonald reports that it has been found impossible to acclimatize the California salmon in the rivers flowing into the Atlantic and in the tributaries of the Mississippi, but that in consequence of artifical fish-culture the Sacramento River yielded twice as many salmon as formerly, and that the annual product of these fisheries had been increased $300,000. The cause of this seems to be that the water of the Western rivers is colder and that of the Eastern and Southern rivers warmer than that of the sea. In France the acclimatization of this fish seems to have been successful in the river Aude, near Narbonne, as the fish return to this river from the Mediterranean.

Mr. von Kalkreuth, of Obragorzig (province of Posen, Prussia), caught a California salmon weighing 5 pounds in the Kurzig Lake.

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*From Circular No. 6, 1884, of the *Deutsche Fischerei-Verein*, Berlin, November 18, 1884. Translated from the German by HERMAN JACOBSON.

While quite young this fish was exhibited in the aquarium of Mayor Schuster at the Berlin International Fishery Exposition.

At Szomolany, Hungary, many of the California salmon died in consequence of the spawn having been extracted. Count Palffy accordingly had the remaining fish placed in the river Waag, with the hope that they would go into the Black Sea and finally stock the Danube. In the autumn of 1882 the number of California salmon was 109, weighing in all 52 pounds.

Baroness von Wattmann, of Cieszanow, Galicia, reports that in her fish-cultural establishment the California salmon had in a year's time grown twice as large as the domestic salmon and trout.

AMERICAN BROOK-TROUT (*Salmo fontinalis*).—This fish is already so thoroughly acclimatized in Germany that 21,684 impregnated eggs could be sent from Cöslin (province of Pomerania, Prussia) and 12,630 from Boitzenburg (Mecklenburg), and that the president of the Fishery Association of Upper Hungary, Count Migazzy, had 17,000 eggs of this fish impregnated at his establishment at Arányos-Maróth. Recently, also, 18,776 eggs were imported from America. If the water does not become too warm during the summer, this fish thrives greatly. At Cleysingen the brook-trout of last year now average in weight one-third of a pound; at Scheibe and Zwatzen the fry of 1883 has grown wonderfully; and at Woschczutz and Wusterbarth the young fish of 1883 have attained a length of 17 centimeters [6.7 inches].

From Starnberg, Bavaria, it is reported that the brook-trout seems to make itself at home in the waters of Upper Bavaria, which are well stocked with these fish. At Georgenbach, near Starnberg, several fine specimens of this fish have been caught with hook and line. The Starnberg fish-cultural establishment contains fish of three years—1882, 1883, and 1884—and eggs have already been obtained from the oldest of these fish. The same observation was made here as at Huningue, that this fish does not endure very well the extraction of its eggs. Nevertheless it is a valuable acquisition to the German waters.

RAINBOW-TROUT (*Salmo irideus*).—This fish, coming from the rivers of the Pacific coast of the United States, was strongly recommended by Director Haack, of Huningue, and the German Fishery Association gave full attention to it. Owing to the kind efforts of the American fish-culturists, a great number of the eggs of this fish has again been imported into Germany. There is all the more reason to rejoice at this, because the transportation of these eggs is connected with considerable difficulty, as it spawns in spring, and as, therefore, the eggs must be transported during the hot season of the year. Mr. Blackford, of New York, from whom we received a quantity of rainbow-trout eggs in exchange for German trout eggs, reports that in the Eastern States the rainbow-trout has changed its habits and occasionally begun to spawn in winter, so that he would perhaps be able to send us eggs as early as December. However, the eggs sent by him, and also those sent by Professor Baird,

were not received till the beginning of spring. On three occasions eggs were sent from New York to Bremen in April and May, and our faithful assistant F. Busse, of Geestemünde, attended to the unpacking, distribution, and shipping of the eggs in the most careful manner. He has always most kindly taken care of the numerous consignments of fish-eggs which we have received from America, and deserves great credit for his exertions in the cause of fish-culture.

Director Haack, of Huningue, regards the rainbow-trout as the most valuable fish that America has sent us. In April, 1884, it appeared that of the fish twenty-one months old, which had reached a weight of one-half to three-fourths pound, not one had been lost. The yield was 10,000 eggs and 1,500 fish. The two-and-one-half-year-old fish in August, 1884, weighed from three-fourths to one pound. In Count Pallfy's establishment at Szomolany, Hungary, 443 rainbow-trout were placed in the water in 1882, and in 1883 the number remaining was 434.

Mayor Schuster, of Freiburg, writes that the fry obtained from the first eggs sent from America were very fine, and that the supply was sufficient to establish permanently the fish in Germany. At Starnberg the American brook-trout has developed better than the rainbow-trout. Mr. Eckardt, of Lübbinchen, from 526 eggs obtained 500 little fish, which did very well in a small pond. Mr. Zenk, of Seewiese, thinks that the rainbow-trout will prove especially adapted to culture in trout ponds.

AMERICAN LANDLOCKED SALMON.—Since 1883 this fish has grown very well near Oliva, Prussia. In the Würm Lake, near Starnberg, a fish of this kind measuring 24 centimeters [about 9½ inches] was recently caught, and a well-grown specimen was taken in the Tegern Lake. In a pond near Friedrichshuld, in Pomerania, such fish thrive very well.

AMERICAN WHITEFISH (*Coregonus albus*).—The *Bayerische Fischerei-Zeitung* (Bavarian Fishery Journal) says, on p. 231, that for the last three years attempts have been made by the German and Bavarian Fishery Associations to acclimatize whitefish in the Ammer, the Tegern, the Walchen, and other lakes in the south of Bavaria. There is good reason to hope for success, as Mr. Höpplinger, superintendent of Bavarian fisheries, a man of considerable experience in matters pertaining to fish-culture, about the beginning of July, 1884, caught such enormous quantities of the American whitefish in the Tegern Lake that he was obliged to submerge the net again in order to set the young fish free. Several well-grown specimens have since then been captured.

The receipts of fish-eggs from Prof. Spencer F. Baird were as follows:

	In 1882–'83.	In 1883–'84.
Salmo fontinalis (Bachsaibling)	45,000	18,776
Salmo irideus (Regenbogenforelle)	9,800	30,651
Trutta lacustris (Seeforelle)		25,000
Coregonus albus (Amerikanische Maräne)	500,000	990,000

73.—THE INJURIOUS EFFECTS OF RAFTING ON THE LAKE AND RIVER FISHERIES OF SWEDEN.*

By Prof. A. J. MALMGREN.

FRESHWATER FISHERIES.—In those parts of our country where these fisheries have been carried on with proper care, they have on the whole not undergone any great changes, and have even in some places become more productive. From most places, however, it is reported that the freshwater fisheries, even in localities where formerly they were very productive and furnished profitable employment to a large class of our people, have declined to such a degree as to make them unprofitable. The causes of this state of affairs vary very considerably. Through the sinking and draining of lakes the fisheries have in some places undergone considerable changes; the area of fishing waters has decreased, while the area of cultivated ground, and with it the population, has increased. In several localities the fisheries have become less productive through the constantly increasing rafting, as thereby it has become difficult and even sometimes impossible for the fish to go to their accustomed spawning places. Saw-mills and other industrial establishments have also had an injurious influence on the fisheries, both by the construction of dikes and by the refuse which is thrown into the water and renders it uninhabitable for fish.

Many complaints come from the district of Gefleborg that both the sea and river fisheries have decreased, especially the salmon fisheries, owing to the increased rafting in the rivers. The same applies to the sea fisheries in the districts of Westernorrland, Westerbotten, and Norrbotten. From all the northern districts it is reported that the fisheries have decreased, and among the causes is mentioned the increased number of saw-mills, which, especially the smaller ones, throw considerable quantities of sawdust into the water, so as sometimes to cover the bottom entirely.

At Atran (in the district of Halland) the salmon fisheries, which in 1875, according to a report made by Maj. M. Kilman, yielded an income of $6,595.77, have now declined to such a degree as only to yield $2,282.50 in 1880. As the cause of this there is assigned the disturbing of the spawning places by excessive quantities of bark from lumber which is rafted down the river, which rafting has been going on for years and is on the increase.

THE LAKE FISHERIES OF THE KALMAR DISTRICT.—It is reported from Jareda, in the county of Aspeland, that in the river Em, which flows through the Jam Lake, many salmon were caught in former times,

* *"Om timmerflottningens skadlighet på insjö- och flodfisket."* From Report of the Swedish Fish Commission, March 3, 1883. Translated from the Swedish by HERMAN JACOBSON.

some weighing as much as 33 pounds, while of late years scarcely any salmon are caught, and those of less weight. In 1880 the heaviest salmon weighed 14½ pounds; and since rafting has begun, the fisheries, and more especially the salmon fisheries, have decreased still further.

THE LAKE FISHERIES OF THE GEFLEBORG DISTRICT.—The Gefleborg district is rich in lakes and streams, and has in former years had very productive freshwater fisheries. It is reported that these fisheries have decreased very much during the last thirty years. Thus the eel fisheries in the Voxna River about the year 1840 annually yielded from 6,000 to 10,000 pounds of eels of the very finest quality, while now the income derived from these fisheries does not pay the expense of carrying them on. The same applies to the salmon fisheries in the Voxna River in its course through the township of Alfta. Formerly these fisheries yielded a good income, but now they hardly pay expenses. In the Delanger River, in the township of Idenor, the whitefish fisheries twenty or thirty years ago annually yielded 600 pounds of fish, while scarcely any are caught now. In this same river many salmon were caught in former years, but now, since rafting is carried on, these fisheries have almost entirely ceased. Rafting has an injurious influence on the fisheries in various ways. The refuse from the rafting gathers on the shores of the lakes, whereby the water becomes polluted to such a degree as to kill the young fish. Schools of fish congregate underneath the large rafts and are killed by the turpentine exuding from the lumber. During the spawning season rafting injures the fisheries in lakes and rivers by large masses of lumber driving the water high up on the shores; the fish deposit their spawn in this water, but before it is hatched the water recedes and the spawn, or occasionally young fry, is left on dry land.

Reports also come from the district of Kopparberg [Falun] that the fisheries have decreased, owing to the same causes as in Gefleborg.

DISTRICT OF JEMTLAND.—The district of Jemtland abounds in large and small lakes, rivers, streams, and brooks. Among the lakes the more important are the Stor Lake, the Kalln Lake, and the Strom Lake. The rivers Ljusnan, Ljungan, and Indal in their upper course flow through this district. In those lakes through which no rivers or streams flow the fisheries have not, as a general rule, undergone any change; but the case is very different with those lakes through which flow rivers on which rafting is done, for here the fisheries have decreased from this cause, and have actually ceased in some places. The salmon fisheries, which are the most important and which have been carried on with special care, have suffered especially from rafting. Thus it is stated that the salmon fisheries in the Ragunda River, which formerly were very productive, have of late years decreased to such a degree as to render them entirely unprofitable. The cause is stated to be the vast quantity of lumber rafted down the river, which rafting is going on from the beginning of spring till the end of summer, while formerly rafting ended toward the end of June. Masses of lumber are often

piled up in great heaps near the banks, causing great damage to the banks and the bottom of the river; and as it often happens that these piles, when once they get in motion, float down the river very swiftly, they drive back the salmon which have sought shelter near the waterfalls. After several futile attempts the salmon become tired and remain below the lower falls; but even there they are often killed, for it is stated that dead salmon are frequently found among the lumber of the rafts.

The loss occasioned by the decrease of these formerly very productive fisheries is felt all the more keenly as the shore owners on the Ragunda Lake are obliged to pay annually 7½ barrels of salmon to the district of Forssa to indemnify them for the loss of their fisheries in the Gedung River. This obligation dates from the year 1796, when the Ragunda owners received permission from the King to open a canal running past the Gedung River, and to drain the Ragunda Lake, which was 2 miles long. The accumulation of lumber which occurs frequently near the place where the Indal River flows into the sea, often covering the entire breadth of the river and sometimes extending even down to the bottom, of course proves a serious hindrance to the salmon in their going up the river. The consequence is that both the river and the lakes connected with it are gradually being deserted by the fish. Urgent requests have been addressed to the commission from Ragunda to have rafting limited to the time when the water is highest, and to have all lumber which is to be rafted completely barked before it is placed in the water, as the bark pollutes the water, and sometimes entirely covers and destroys the spawning places.

District of Westernorrland.—The fisheries in the lakes and rivers of this district are reported to have decreased considerably from the same causes as in Jemtland, and it is stated that the dams built for saw-mills and other mills and for rafting are constructed in such a manner as to make it impossible for the fish to ascend and descend the watercourses. From Fjellsjö it is reported that the fisheries have decreased to such a degree as to render them entirely unprofitable, and it is stated that no one cares to set nets which are in constant danger of being disturbed by rafting.

District of Westerbotten.—In some parts of this district the freshwater fisheries are said to have decreased, while in others they have remained the same as in former times. This applies particularly to the smaller lakes, through which no rivers flow in which rafting is going on; while the fisheries have decreased in all those streams where lumber is rafted, and where dams have been constructed.

District of Norrbotten.—The decline of the fisheries in this district is more general than in the more northerly districts. All the reports agree in this with the exception of Lake Storafvan, where the fisheries are the same as in former times.

Helsingfors, Finland, Russia, *November* 30, 1884.

74.—ORGANIC MATTER IN THE BALTIC.

By Prof. V. HENSEN.

[Abstract of a paper read at the Sleswick-Holstein Physiological Association, January 12, 1885.]*

An investigation to determine the quantity of organic matter in the western portion of the Baltic, exclusive of the harbors and bays, has been in progress since August, 1884, at the request of the commission for the investigation of the German seas.

The theoretical basis for such an investigation is given in a paper on "The Occurrence and Quantity of Eggs of some Fish in the Baltic."† The investigation was based on the supposition that the constant shaking motion prevailing in the sea distributes all matter floating in its waters almost evenly, and that, on the other hand, the conditions of growth and increase for the various formations floating in the water (partly objectless and partly with no other object than to seek food) are everywhere the same in water of the same character.

Practical investigations have tended to prove the correctness of this theory. The distribution of matter was of course not absolutely even. A shaking process would bring about a close approach to even distribution, but could never make it perfect. Moreover, there was a lively exchange in the basin in question between the waters of the Cattegat and those of the Eastern Baltic, rendering the even distribution liable to constant disturbances. It appears, however, that when the steamer is anchored, and successive columns of water (of 3, 5, 7, &c., meters depth) are examined as to their contents, the entire quantity of organic matter and of individuals is approximately proportionate to the volume of water which has been examined; that therefore the distribution of matter in this portion of the Baltic, whose depth rarely exceeds 20 meters, corresponds approximately to this depth. In fishing a number of times in succession in a column of water of equal depth, while the current passes the anchored vessel, the catches will vary in quantity and numerical composition, but the differences do not exceed 50 per cent.

As far as could be ascertained, the catches in the Baltic between the Holstein shores and the nearest Danish islands would not vary 50 per cent from the average of the first catches referred to above. As there was sufficient agreement between the results obtained by continuous fishing near the surface, as the steamer pursued its course, and the results obtained at points where a halt was made, a tolerably correct idea of

* "*Sitzung des physiologischen Vereins, den 12. Januar* 1885." From *Mittheilungen für den Verein Schleswig-Holsteinischer Aerzte*, Part X, No. 7, 1885. Translated from the German by HERMAN JACOBSON.

† See Fish Commission Report, 1882, p. 427.

the contents of large sea areas may certainly be gained, provided the apparatus used is sufficiently accurate.

The importance of such investigations for the physiological knowledge of the sea is greater than may appear at first sight. The first question to be decided was one which had so far hardly been considered seriously, namely, whether the light of the sun exercises in the water of the sea the same germinating influence as in the air and on the land. By these investigations this question has been answered in the affirmative. In December, for example, there ha been found in 10 cubic meters of water more than 100,000,000 of plants dependent on sunlight (*Rhizosolenia alata*, 80,000,000; *Chætoceros*, 3 species, 62,000,000), all vigorously increasing, and this entire mass of plants had been produced in the course of about two months. Most of these plants sprouting in salt water belonged to the simplest products of the vegetable kingdom, and therefore appeared particularly adapted to decide general questions of generation.

Even among the animals living on the coast there are but few which live on firmly rooted plants, and it is an erroneous idea that during autumn and winter a sufficient quantity of particles was torn off, which floated in the sea and served as food for the copepods and other animals, for even in the Baltic the quantity of such floating matter was very small. The vast majority of marine animals (such as fungi, polyps, worms, ascidians, mussels, a great many snails, crustaceans, and higher animals) live, most of them directly and a few indirectly, on floating matter, which in its lower forms must, therefore, be considered as the animated original material of the life of the sea.

If we can believe that light, which as a fact exercises a generating influence in the sea, is used to the fullest extent possible, we arrive at a remarkable conclusion. As the organic beings in the sea need not protect themselves against lack of salt and moisture, they can be of lighter build and of a lower organization than land and freshwater animals. That they are of a lower organization can actually be shown. The conclusion would therefore be drawn that the same quantity of light must be able to bind together more carbon and nitrogen in the sea than on the land, and that in the sea more organic matter must be generated than on the land, provided not too much light is reflected from the surface of the sea.

The investigations made in the western part of the Baltic have shown that the quantity of matter floating in its waters is so great as to indicate an annual production not much smaller than that of an equal area of land. When it is considered that wherever animals are rooted to the bottom of the sea there must be floating matter to supply them with food, we feel inclined to the opinion that the quantity of organic and animated beings floating in the sea must be enormous.

It was not astonishing that this powerful generative activity had hitherto almost escaped our observations, as thus far no one has en-

deavored to ascertain the quantity of matter floating in the sea.* It was difficult to make such observations, because one formation passed away after a few months, to give way to others. No such accumulation of full-grown matter as is found everywhere on the land can, therefore, be looked for in the sea.

75.—HYDROGRAPHIC WORK OF THE ALBATROSS IN 1884.

By Lieut. SEATON SCHROEDER, U. S. N.

During the year 1884 the Albatross took 701 soundings, almost all of which were located with sufficient accuracy to give them hydrographic value. During the winter and spring the vessel was employed by the Navy Department in searching for reported dangers in the West Indies and on the way there, runnings lines of soundings across the Caribbean Sea and among some of the islands, noting currents carefully, and establishing the longitude of Cape San Antonio lighthouse, Cuba.

The following are the reported dangers over or near which the depths were found in the positions given:

Name.	Latitude.	Longitude.	Depth.
	° ′ ″	° ′ ″	*Fathoms.*
Orion Shoal	34 48 45	72 25 00	2,462
Ashton Shoal	33 50 20	71 42 00	2,953
Penseveranza Shoal	31 15 42	67 39 10	2,787
Mourand Shoal	24 55 14	65 13 07	3,006
Leighton Rock	17 39 30	73 22 15	2,490
Loos Shoal	17 48 00	73 34 15	2,369
Breakers	12 54 40	66 11 10	2,768
Vigia	12 10 30	66 11 00	2,707
Georgia Shoal*	...	...	17
Tribune Shoal	12 11 30	74 27 30	2,057
Powhatan Shoal	11 11 00	75 50 30	1,195
Doubtful	14 53 40	80 20 00	1,151
Sancho Pardo†	...	...	...
Albatross Shoal	22 49 20	84 15 00	950
Vigia	23 06 00	83 03 45	625
Huntley	30 46 00	78 35 00	470

* Many soundings.

† Off Cape San Antonio; many.

The soundings were such as to prove the non existence of all except the Georgia Shoal, reported by Captain Holt, of the American brig Georgia, in 1867. An extensive search was made for this, resulting in the discovery of a bank a little to the southward of the reported position, in latitude 17° 36′ to 17° 44′ N. and longitude 75° 40′ to 75° 45′ W. The least water found by the Albatross was 17 fathoms.

One hundred soundings were taken off Cape San Antonio, and the shoal reported there may be expunged from the charts.

Six lines of soundings were run across the Caribbean Sea, four be-

* The only person who has done something in this line is Murray, of the Challenger expedition.

tween the Leeward Islands and the main, and diagonal lines on and off the coast of the United States of Colombia. The eastern part of the Caribbean Sea is the deepest; the greatest depth was 2,844 fathoms, in latitude 13° 25′, longitude 66° 25′. Still deeper water, however, was found off the Honduras coast, there being 3,169 fathoms 60 miles SW. of the Grand Cayman.

One interesting discovery was that of a submarine ridge connecting the islands of Santa Cruz and Porto Rico, the least depth on which was 578 fathoms and the greatest 900, while on either side was found over 2,000 fathoms.

Aves Islet, 100 miles westward of Guadaloupe, was found to be the summit of a mountain extremely precipitous on its western slope, and extending in a SSE. direction over 150 miles to the 1,000 fathom curve.

All these features are shown in a plaster cast of the West Indies and Caribbean Sea, made at the Hydrographic Office, Navy Department.

The longitude of Cape San Antonio lighthouse, west end of Cuba, was determined by sextant observations, the longitude being carried by five chronometers from Key West, Fla., and depending on that of the Soldiers' Monument, being 81° 48′ 25″ W.

The general results of the study of the currents are as follows:

The general surface drift in the Caribbean Sea is to the westward, being much the stronger in the eastern part, where as much as 3 knots was found off (northward of) the Leeward Isles. The tidal influences at Grenada Island unquestionably extend 60 miles to the westward, and near the shores of Santo Domingo and Jamaica there are many eddies, &c., that may be somewhat tidal. The direction and strength of the wind have an influence upon the exact set of the stream; but it is noticeable that in the eastern portion of the Caribbean Sea the set is generally to the southward of west in the northern part, and to the northward of west in the southern part. For 200 or 300 miles westward of the Gulf of Paria the current ran 2 to 3 knots to about NW. by W., in spite of a NE. breeze.

In the broad channel between Yucatan and Honduras in the west and Cuba and Jamaica in the east the currents are extremely erratic. The amount of northwesterly drift in twenty-four hours was found generally to tally with what vessels have usually experienced there; but during individual hours or portions of a day there were remarkable fluctuations noted. In one instance the current was to WNW. 2½ knots at one time; in less than two hours it was setting feebly eastward, and again in two hours more to SW., and so on. This may be caused by the extraordinary variations in the depth, nearly 3,200 fathoms being found 75 miles eastward of Swan Islet (60 feet high), 3,000 fathoms at 40 miles southeastward of Misteriosa Bank (10 fathoms), and so on.

During the summer and autumn of 1884 the soundings taken by the Albatross were off the coast between Hatteras and Nantucket, in various depths up to 2,700 fathoms. Nothing was found of special hydrographic value.

76.—LAWS OF INLAND WATERS.

By Hon. THEODORE LYMAN.

[Answer to questions of Monsieur de Lomenie.]

In dealing with the laws of the United States, it is important for a foreigner to remember that the rights of the States individually are sharply distinguished from those of the National Government as defined by the Constitution.

Within the limits of the States there is no such thing as a Federal river. Rivers of all sizes belong to the riparian proprietors, opposite proprietors owning *ad filum aquæ*. Their proprietorship on navigable rivers is subject to the easement of the passage of vessels. Furthermore, their ownership of the water, like that of the land, is subject to the eminent domain of the State (not of the United States). This ownership of the water carries with it that of the fisheries and such other privileges as may naturally accrue. The State, however, can regulate the time and manner of fishing for the general benefit.

In Massachusetts the proprietorship of ponds is not like that of rivers. If the pond does not exceed 20 acres in extent, it belongs to the riparian owners; but if it does exceed 20 acres, then it belongs to the State. To this law there are a few exceptions. They are ponds exceeding 20 acres in extent which were granted in Colonial times to individuals by royal charter.

As Massachusetts is one of the oldest States, her laws will illustrate those of many others. In the Sixth Annual Report of her commissioners of fisheries, sent herewith, in the appendix, will be found her laws on fisheries from the earliest times to 1871. On page 258 will be found a general act, which will give a good idea of the powers of the State. In the Fifth Annual Report, page 29, will be found the arguments and hearing in the case of the Commissioners of Inland Fisheries *vs.* The Holyoke Water-Power Company; and in the Eighth Annual Report, page 49, will be found the final decision of this case by the Supreme Judicial Court of the United States, affirming the decision of the Supreme Court of Massachusetts. This is one of the most interesting cases of its kind ever decided. It involves the rights of river fisheries, of water-power corporations, and of the eminent domain of the State over both.

The Holyoke Company got a charter from the State authorizing the construction of a dam across the Connecticut River to create water-power for manufacturing. This dam was so high that it would stop the passage of shad (*Alosa sapidissima*) and other fishes. The State imposed the condition that the company should pay for the fisheries thus destroyed *above* the dam. It did pay for them and erected the dam.

The common law enjoins on any owner of a dam which is high enough to stop the passage of fish to supply a suitable fishway to carry the fish over the dam. Under this law the commissioners of fisheries ordered the Holyoke Company to build a fishway. The company replied that it was exempt from the common-law injunction to build a fishway, because it already had paid for the fisheries destroyed above the dam, as laid down in its charter.

The court held, first, that what is not specially granted in the charter is specially withheld; second, that the company had injured the fisheries *below* the dam, besides destroying those *above* the dam; third, that it therefore was subject to the common law, and must build a fishway.

BROOKLINE, MASS., *May*, 1885.

77.—HATCHING SALMON EGGS AT MONTPELLIER, FRANCE, AND TROUBLE WITH FUNGUS.

By Prof. VALÉRY-MAYET.

[From a letter to Raveret-Wattel, secretary of the Acclimation Society.]

My salmon breeding, which began so well, has ended in complete failure. I wrote you on February 14 that the eggs had arrived in good condition. About the 25th hatching began, and was finished by the end of the month. During the first part of March all went well, but about the 10th a serious disease suddenly broke out, and nothing was able to stop this epidemic, which, I believe, has for its cause an aquatic fungus of the genus *Saprolegnia*. In short, by March 30 all were dead of this disease. The white threads of the fungus must have penetrated the gills, as I have noticed that the disease began in this region and that all the dead fish had their gills thus covered.

To what must we charge this failure? In order to avoid the high temperature of my grounds (an inclosure that had at noon between 20° and 30° C.), I placed my breeding-pans in a cellar where the thermometer ranges between 10° and 12° C. and the water never exceeded 12° C. In spite of a large opening, was that cellar too dark? This is possible, for the fungus grows more rapidly in a rather dark place. On the other hand, I could not think of putting my pans in the open air. My cellar, which was light enough for a place of that nature, had a regular outlet in a neighboring drain. The water has always run off in a suitable way, and I considered this sufficient.

I must add that this was the first time that I tried hatching salmon in March. Those eggs which you intrusted to me in former years, and which succeeded, were hatched in December and January, during very cold weather. March is a little late for a country where vegetation always starts by February, and sometimes earlier.

MONTPELLIER, FRANCE, *April* 3, 1885.

Vol. V, No. 18. Washington, D. C. Aug. 18, 1885.

78. HATCHING AMERICAN FISH AT SOUTH KENSINGTON, AND THEIR INTRODUCTION TO ENGLISH WATERS.

By HENRY FFENNELL.

[From Land and Water, May 2, 1885.]

Thanks to the liberality of the Commission of Fish and Fisheries of the United States, visitors to the Inventions Exhibition at South Kensington have the opportunity for a few weeks of watching the hatching out of the ova of various kinds of fish which have been sent across the Atlantic to the council of the National Fish Culture Association, under whose direction the aquarium attached to the exhibition buildings has been for the last two years. Not long ago it appeared highly probable that by May 4 the breeding-troughs would be tenantless. The different consignments of eggs which had been sent from time to time had hatched out so quickly and the fry had grown so rapidly that it was found necessary to remove the latter to more suitable quarters for the rearing of the fish. Within the last few weeks, however, fresh consignments of ova have arrived, and for some time to come the troughs will contain a fine collection of eggs, representing fish hitherto unknown in English waters.

Among the eggs forwarded from time to time by the American Government are those of the lake-trout (*Salvelinus namaycush*), the rainbow-trout (*Salmo irideus*), the Atlantic or Penobscot salmon, the landlocked or Schoodic salmon (*Salmo salar* subsp. *sebago*), the quinnat salmon, the whitefish (*Coregonus clupeiformis*), and the brook-trout (*Salvelinus fontinalis*).

Referring in inverted order to the fish mentioned above, the American brook-trout is the only one of which we have had any experience as to the practicability of introducing it to our home waters; and it must be said that so far little or no success has followed the attempts to acclimatize this pretty-looking and, I believe, gamy fish. For many years past thousands of fry have been turned in from time to time to various waters, and the result may be said to be comparatively nothing. *Fontinalis* of good size are, indeed, occasionally taken here and there, but not in sufficient numbers to give evidence that they have really been established. Mr. J. T. Mann, who for several consecutive years took great pains to introduce the *fontinalis* into his fishery in Hampshire, tells me the results were most unsatisfactory. So far as he was concerned, he benefited little by the experiment. The fish appeared to have wandered up stream above his water, where some were taken, but not in any great

numbers. From others I have heard the same story, viz, the *fontinalis*, although apparently a fish suitable to our streams, appears for some reason or other not to multiply therein.

The whitefish, the eggs of which have hatched out very quickly at South Kensington, is a great commercial fish in America. They are very prolific spawners, and with the aid of artificial culture a vast amount of these fish are annually reared in the United States. Mr. Silk, the intelligent pisciculturist to the Marquis of Exeter, whose frequent journeys to America and Canada give him exceptional opportunities of studying the many questions connected with the fisheries of those countries, tells me that an extensive trade is carried on in salting these fish, which in that condition find a ready sale throughout the States. They frequent deep lakes, spawning on the shallow shores, where they lay their ova in vast quantities. Mr. Clark, of the United States Commission, has lately been making some interesting experiments in rearing whitefish in confinement, with the aid of artificial feeding. The experiments have been carried on at the Northville hatchery, where he placed in confinement 1,200 which had been hatched on March 12. In September 276 were alive and in good condition, and many of them had grown as much as 6 inches in length. They were fed exclusively on liver. The Marquis of Lorne has taken a great interest in the introduction of this fish to our English, Irish, and Scotch lakes, and at his suggestion a large consignment of eggs was lately received at South Kensington.

The fry produced from the first batch of eggs, which arrived at the aquarium some time ago, have been distributed in various places. The Marquis of Exeter turned in a vast number to his large pond at Burleigh Park, where it is to be hoped they will escape the ravages of the older inhabitants. A baby whitefish seems to be a very tempting morsel for other fish. They may, perhaps, hide themselves away among the weeds, out of harm's way, and perhaps by and by we shall hear of their establishment at Burleigh. Two batches of whitefish fry have been sent to the MacLaine of Lochbuy, with a view to stocking his waters in the Isle of Mull. The first batch, unfortunately, were all dead before they reached their destination. The other lot left London the other day, and I have not yet heard how they bore the journey. A number of the whitefish fry have been sent down to the Fish Culture Association's fishery at Delaford Park, where, under the direction of the energetic secretary, Mr. Oldham Chambers, a series of ponds have been made for rearing purposes; and I understand that the fish, which are fed on liver, are flourishing, having grown considerably since they left South Kensington. A number of fry of the other American fish have also been placed in the ponds, and are said to be doing remarkably well.

The above-mentioned fish, with one exception, as I have said, are unknown in English waters, and I think warm thanks are due to Prof.

Spencer F. Baird, the Commissioner of American Fisheries, for the great trouble he has taken and the great liberality he has shown in sending over such varied consignments of fish-eggs. They arrived in splendid condition, a fact which does high credit to those to whom the packing of the eggs was intrusted. I must make one exception as to the condition of the eggs when they arrived. This refers to a box containing ova of the rainbow-trout, which reached London last Saturday. A number of these were dead on arrival, and others have been dying off during the last few days; but I hope some hundreds will be hatched out.

The hatching and rearing of these fish will be watched with great interest; but I think the question should be closely considered as to whether the introduction of any of the above-named would really be an advantage to our home waters. It may be that in some places where the fisheries at present are of little account they would thrive and multiply, but I think that strict caution should be observed in introducing these foreigners to our salmon and trout streams, and that we must not be too sanguine of good results accruing therefrom. The cross-breeding of fish should not be done at hap-hazard, and experiments ought to be carried on with due discrimination. If we can improve on our own salmon and trout (speaking generally), well and good; but I doubt it.

79.—AN ATTEMPT TO IMPREGNATE ARTIFICIALLY THE EGGS OF ACIPENSER STELLATUS.*

By N. BORODIN.

In 1869 Mr. Owsjanikoff, member of the Russian Academy, made the first attempt to impregnate artificially the roe of the sterlet, which at the same time was the first attempt at the artificial impregnation of ganoids, which for a long time had baffled all experiments. It was, therefore, to be hoped that success would also accompany similar experiments with larger varieties of the *Acipenser*, such as *Acipenser stellatus*, *A. güldenstädtii*, and *A. huso*, which form the objects of extensive fisheries in the Caspian Sea and the rivers flowing into it. Experiments must prove this, however, and these are of special interest, because on them would depend the practical application of fish-culture to these kinds of fish. Thus far these experiments have not been made. It is true that Max von dem Borne, in his "*Fischzucht*," states that the American fish-culturists Seth Green and Marks, in 1875, made experiments with the roe of *Acipenser sturio* in Hudson's Bay; but the description of

* "*Ein Versuch künstlicher Befruchtung des Rogens des Sternhausen.*" From the *Deutsche Fischerei-Zeitung*, vol. viii, No. 14, Stettin, April 7, 1885. Translated from the German by HERMAN JACOBSON.

the method employed by them leaves room for doubt as to the success which they say crowned their efforts.

Last spring I was commissioned by the St. Petersburg Society of Naturalists to make experiments with the roe of the *Acipenser stellatus*. These experiments were made at the mouth of the Ural River, not far from the Caspian Sea. In spring the Uralian Cossacks are in that place engaged in extensive fisheries for various kinds of *Acipenser*. The manner of fishing is so peculiar that it is mentioned in some well-known German works.* At the end of May I obtained an *Acipenser stellatus* with mature roe, and made the experiment of impregnation according to the dry or Russian method, with previously prepared milt. The roe was put on plates; the water was changed twice a day; and some of the roe was put in a basket and placed in the river. The development (at a temperature of 17° or 18° R., or about 71° F.) progressed very rapidly. On the second day a small furrow could be observed on the eggs, and on the third day some of the fish had slipped out of the eggs. In the river the development progressed more rapidly, in spite of the lower temperature (16° R., or 68° F.), but here the roe was covered too much with mud and most of it perished. The development on the plates was very satisfactory. It should be stated, however, that, owing to the sticky character of the roe, it has to be put in single layers, separated from each other as much as possible; otherwise much of it will perish. After five days the young fish can easily be recognized as *Acipenser stellatus;* after twelve days the umbilical sac disappears entirely, and the little fish strongly resembles the grown fish, with the exception of the snout, which is not as long as in the *A. stellatus*, but short, as in the *A. huso* and *A. sturio*. It should be noted that these young fish, like the young of the sterlet, have strongly developed teeth (in number $\frac{6.6}{5.5}$), which are not found in the grown fish.

By these experiments it has been demonstrated that it is possible to impregnate artifically the roe of *Acipenser stellatus*. It has also been proved that in the Ural the so-called "salt-water fish-culture," as with the Americans, may be begun with the culture of the *Acipenser stellatus* and probably other varieties of the *Acipenser*.

It is to be hoped that in the near future practical experiments on a large scale may be made in the Ural. This is all the more feasible, as the river for a distance of 500 versts [about 330 miles] and a portion of the sea, belong to the same Cossack community, with a population in all of 80,000.

As regards the other kinds of *Acipenser* (*A. huso*, *A. güldenstädtii*, &c.), I did not succeed in making experiments last spring, because I had no assistant. This spring, however, I shall endeavor to make up for lost time, and shall not fail to report the results of my experiments to the German fish culturists.

* Pallas, "*Reise*," Vol. I. Hansteen: "*Reise-Erinnerungen aus Sibirien.*" "*Die uralischen Kosacken und der Fischfang auf dem Uralstrom*," *Aus allen Welttheilen*, 1873, August.

80.—LIVE FOOD FOR YOUNG FISH.*

By Dr. SCHWAAB.

So many reliable reports have been made in detail on the production, shipping, and hatching of the eggs of food-fish, that a report of this or that one's personal experience can scarcely add much to our knowledge of the subject. Some data may, however, be useful regarding the feeding of young fish at the time when the umbilical sac disappears, and when the lack of suitable food frequently causes deplorable losses of promising fry. During last summer I made some observations regarding live food in the hatchery of *Karthaus-Prüll*. Quite young fish in the beginning generally refused dead food, such as pounded brains, veal chopped fine, fish entrails cut up small, which is eagerly taken by larger fish; and every fish-culturist knows what trouble and perseverance is required to induce young fish to take this food. While young trout, and especially the young of *Salmo hucho*, will take dead food, sinking to the bottom, only with great hesitation or not at all, it is surprising to see with what eagerness the young fish snatch at suitable live food. Scarcely has the live food been placed in the tank when the attention of the young fish is attracted to it, and immediately they begin to chase it. In the beginning the young fish frequently dash past the prey, as young chickens will often in their inexperience pick the ground by the side of the grain; often they drop the food, to seize it again immediately. Sometimes two or more make a dash at the same object, or they endeavor to pull the half-swallowed prey out of the mouth of some other fish. By the most ludicrous leaps and turns they endeavor to hold fast to the live morsels and to swallow them. If we compare the way in which young fish treat live food with the manner in which they treat dead or unnatural food, we will at once become convinced that live food is better adapted to their needs. As the experiments in feeding young fish with live food, begun last summer and continued till autumn, were successful, it is deemed proper to publish a report on them, in the interest of other fish-cultural establishments, although they cannot claim to be complete, because the time of observation and the space in which these experiments were made were limited.

Besides some specimens of aquatic animalcules whose names we did not know, the food consisted of—

1. The *Cyclops quadricornis;* and
2. The larva and chrysalis of the *Culex.*

The *Cyclops quadricornis* belongs to a very numerous family of crustaceans which are found in puddles and ponds, are exceedingly pro-

*"*Lebendes Futter für junge Fische.*" From Circular No. 2, 1885, of the German Fishery Association, Berlin, April 4, 1885. Translated from the German by HERMAN JACOBSON.

lific, and which are called *Cyclops* on account of the single eye in the middle of the flat head. Owing to its small size the *Cyclops* proves a welcome food to all young fish. We got them from a stone basin, about a meter deep, located under large chestnut trees, where the water changed but little and where there were not too many algæ.

In order to obtain a larger number of *Cyclops* I had a large barrel filled with water from this basin. In doing this I was guided by a recollection from my boyhood's days—how that in a barrel containing rain-water numerous exceedingly lively animalcules were observed by us, and it seemed a perfect miracle to our childish thought that these little beings could have originated in the rain-water barrel. I lived in hopes that the same phenomenon would repeat itself in the present case. The experiment was entirely successful, for in even larger number than the *Cyclops* there soon appeared new animalcules, which turned out to be the larva and chrysalis forms of the *Culex*. How often has the question been asked, For what purpose is the *Culex* in this world, and of what possible use can it be? [The *Culex* is simply a musquito or gnat.] Before attempting to answer this question we must notice the life of these insects, and especially of that variety which, on account of the singing noise it makes, is called *Culex pipiens*, and whose "better half"—only the female *Culex* stings—causes men on fine summer evenings to express a doubt as to their right of existence.

If in winter, by means of a candle, we examine somewhat closely the vaulted ceilings and walls of a cellar, we frequently find in moist or dark places hundreds and even thousands of gnats (*Culex*); these are the females of the generation produced in autumn, which in these sheltered places, in a sort of torpor, wait for spring. When the sun rises higher in the heavens and warm spring days come, when the ice disappears from ponds and puddles, the gnats leave their winter quarters and begin the propagating process. For this purpose they seek some sheet of water, settle along its edges or on a floating leaf or blade of grass, bend the point of the back part of their body toward the water, and lay their dark-colored long eggs, running to a point. These eggs adhere to each other with their long sides, and when thus united resemble a small boat pointed in front and back and slightly hollowed out on the top. Such a pile of eggs floating along the surface of the water and adhering to the edges is the result of a single act of laying, and contains from 200 to 350 eggs. After a few days the hardly visible larvæ slip from the eggs on the side turned toward the water, and move about in this their proper element. The entire process resembles the more easily observed laying of eggs by butterflies, and the hatching of their larvæ, the voracious caterpillars.

The young larvæ of the *Culex*, after they have reached the water, grow rapidly, feeding on exceedingly fine vegetable formations such as are always found in great abundance in the mud of stagnant water, and change their skin several times. They are generally seen floating on

the surface of the water; the head is bent downward and the respiratory tube, surrounded by very fine cilia, points upward like a finger. If one reaches for them, or slightly agitates the surface of the water, they go rapidly toward the bottom with quick, eel-like wriggles, to rise again in a similar manner after a short time.

After the skin has changed for the last time the larva becomes a chrysalis. The larva and chrysalis are as different from each other as the chrysalis of a butterfly from a caterpillar. But while the chrysalis of a caterpillar remains immovable, the chrysalis of the *Culex*, when in the water, is hardly less lively than its larva; and it is, therefore, not astonishing that it has sometimes been taken for a separate aquatic animal. It differs from the larva by its form and the manner in which it carries itself. When quietly resting on the surface of the water it has its thick, plump head turned upward; from the head two respiratory tubes protrude above the surface like two little pointed ears, while the larva has only one respiratory tube, which is somewhat longer and starts from the back part of the body. After eight or ten days the *Culex* slips out of the chrysalis, and the empty chrysalis shells may then frequently be seen floating on the water.

Every female *Culex* lays, on an average, 300 eggs, and after that it dies. The development from the egg to the larva, chrysalis, and the young winged insect is completed in four or five weeks. From spring till autumn about six generations may, therefore, follow each other, in enormously growing proportion; and the vast number of these insects will no longer seem astonishing, their cradle being the water. The water, however, is not only the cradle of thousands and millions of these insects, but it also becomes the early grave of a great many of them; for other animals living in the water, particularly fish, devour every day enormous numbers of these larvæ.

In what manner may the larvæ of the *Culex* be obtained, so as to form the food of artificially hatched young fish? The answer will not be difficult after all that has been said. In the beginning of spring some open receptacle for water, such as an old barrel or tub, is placed somewhere in the open air and filled with water, to which it will be well to add some pond-mud, leaves, decaying straw and perhaps cow-dung, in order to form a basis for the development of the lower grades of vegetable forms which serve as food for the larvæ. After a short time the beginning of animal life may be noticed in the water, which should be filled up from time to time, and soon the barrel will contain thousands of larvæ of the *Culex*. These can be taken out with a gauze dipper, or they may be obtained in the following manner: A rubber tube, as thick as a little finger and from 50 to 80 meters long, serves as a siphon. In order to avoid the disagreeable sucking of the tube, which often results in getting the mouth full of dirty water, the entire tube is put under the water, the air is allowed to escape, one end of the tube is then pressed together with the thumb and forefinger and is pulled

over the edge of the barrel, while the other is left hanging in the water. After stopping the pressure of the fingers the water flows from the free end of the rubber tube and is allowed to flow through a filter (a piece of coarse linen, a pocket-handkerchief, &c.). The larvæ are carried by the current of the water into and through the rubber tube and remain on the filter, on which they may be gathered in any desired quantity; then, on the the improvised filtering cloth they may be transferred to the fish tank, where they can easily be washed from the cloth and thus brought into the water. When the water flows into the tank freely the larvæ are easily driven toward the exit-grate and hindered in their free movements, whereby they are lost to the fish. It is, therefore, advisable, during feeding, temporarily to stop the flow of fresh water into the tank, or at least to diminish its force.

This excellent live food, which can easily be obtained all through the summer, does not exclude the use of fresh dead food, to which we referred in the beginning of this article; and we found that very finely chopped fish-worms were gladly taken by the young fish.

84.—SUCCESS IN HATCHING LOBSTER EGGS IN NORWAY.

By G. M. DANNEVIG.

[From a letter to Prof. S. F. Baird.]

I have the pleasure of informing you that the experiments with the hatching of detached lobster eggs are progressing very favorably. The young are doing well, and some of them have attained what Prof. G. O. Sars calls the third stage. The length of the young lobster soon after hatching is about 9 millimeters; after eight days, when the second changing of the shell or skin takes place, it has attained the length of 12 millimeters; and after sixteen days, when the third change occurs, it is about 15 millimeters long.

For some days the mortality was rather great, but now only 2 or 3 die in twenty-four hours; so that out of 200 picked out for an experiment 95 still remain. They are very greedy, but not so inclined to kill one another as they were at the beginning. I feed them principally with the soft parts of our crab (*Cancer mœnus*, or *Cancer pagurus*, as some call it), which they like very well; but their slender legs sometimes become entangled in the soft mass, and then they die. Five hundred newly hatched individuals are now in a separate apparatus for further experiments, and I wish to find out at what stage the greatest loss takes place. I have great hopes now that I shall master this question during the season, so that I can proceed on a large scale next summer.

FLODEVIG, NEAR ARENDAL, NORWAY, *July* 14, 1885.

82.—ITALIAN FISHERMEN IN SAN FRANCISCO.

[From the San Francisco Chronicle, July 20, 1885.]

The branch of the fishing industry of this city represented by the picturesque Italian fishermen's market on the sea-wall employs over 1,000 men. They are the Italians who supply the city markets with deep-water fish, but of course they do not supply all the fish used in the city, as the Italian fishermen of Monterey Bay, the Chinese fishermen of San Francisco Bay, the Italian fishermen of the Sacramento River, and the American fishermen of the mountain lakes and streams all add their product to make up the tons of fish daily consumed or packed in San Francisco. But the Italians do most of the fishing for the city, doing a deal of hard and dangerous work, and earning the short leisure they so much enjoy. Much has been written about the picturesqueness of the Italians and their lateen-rigged boats occupying the fishermen's wharf and the sea-wall market, but little has ever been said about the practical side of their business. They are not always engaged in lounging on the decks of their pretty boats, smoking cigarettes, and gossiping volubly, or mending their nets on the sunny side of the wharf. There are so many of their boats—265 make use of the new wharf—that there are always enough of them in the slip to give the casual observer the common impression that their chief end and aim is to make that part of the water-front look as much as possible like the Bay of Naples.

Each of the 265 fishing-boats above-mentioned is owned in partnership by the crew that works it. These crews range from three to six men in number, and altogether they have about $35,000 invested in their boats and fishing-tackle. The largest crews are not always carried by the largest boats, as the character of the fishing a boat is used for, rather than its size, determines the number of its crew. The boats on which line-fishing is done carry six men, while the net fishing boats carry three or four. The amateur fisherman, who finds one rod and line quite as much as he has the skill to attend to properly, will agree that six men are none too many for a boat from which 7,000 hooks and lines are thrown. This is the number of hooks one of the large-sized boats casts when it is out for rock-cod and kindred fish.

The net-boats, which cast for tomcod, flounders, soles, and anything else their meshes will hold, go outside from fifty to a hundred miles. In summer they run down as far as Monterey Bay, and in winter they go farther north than Tomales Bay. The little craft are carefully prepared for each journey out to sea. Nets are overhauled, mended, and carefully laid; hooks are baited, and lines coiled; the false bottoms are taken out and scrubbed; everything pertaining to the work in hand is made snug and ship-shape; and then the provisions for a three or four

days' trip are laid in. This last is to the Italian a labor of love. Big, round loaves of bread, numerous demijohns of red wine, coffee, fresh meat, and salt fish—salt fish, when tons of fresh fish are to be caught!—are stowed in the larder, and charcoal for the little cooking furnace is always taken. But this fare is not all. If the weather permits, the boats during the trip are run in near shore, and a landing is made by the small boat at some convenient ranch where eggs, butter, milk, and chickens can be bought or exchanged for fresh fish. These fishermen live well and drink enormous quantities of red wine. Their duties generally keep them wet through whenever they are on deck, and they feel the need of something warming when they go below to the snug little forecastle, where dry clothing and the little furnace are not always enough to counteract the effect of the cold and wet on deck. The trips outside cannot be prolonged over three or four days, for the goods they drag from the depths are perishable, and a run in to the market must be made whether the forward hold is filled or only half filled with fish.

When the wharf is reached the fish are assorted, placed in the small open boxes such as are commonly seen in the fish-market stalls, weighed, marked, and piled up in the market on the wharf, ready for the next morning's sales. The wharf fish-market is the earliest-opened place of business in the city. Every week-day it is opened between 2 and 3 o'clock in the morning, except on Friday, when the sale begins at 1 o'clock in the morning. The market men and peddlers are the only purchasers. Caterers for hotels and big restaurants are commonly supposed to buy at the wharf market, but this is a mistake, as that market sells only to middlemen. Each boat has a representative in the market, and every Saturday night he divides the proceeds of the week's sales among his partners. The sales of fish at this market amount to 50,000 pounds per day, and sometimes more on Friday morning and somewhat less upon other mornings.

The Italian Fishermen's Association rents the wharf from the State, and each boat is assessed a dollar a month to pay the rent and other expenses incident to the place. Besides the market the association maintains a "boiler-house," where the nets and lines of the fishermen are boiled with oak bark, and has means for hauling the boats out of the slip and on the wharf up a broad gangway leading down into the water. Although the new slip and wharf are more commodious than the old, the Italians do not like the place well, and for a characteristic reason: it is more exposed, and therefore more windy and cold. They do not growl at the wind and water and cold while outside in their boats, but in port they want calm and warmth, where cigarette smoking and gossiping may be indulged in under the most favorable circumstances. But this objection will be obviated in time, as the new land made by the filling in of the sea-wall and back of it will soon be built up with warehouses, and the present quarters will be well sheltered.

83.—RAISING CARP IN RICE-FIELDS.

By R. J. DONALDSON.

[From a letter to Prof. S. F. Baird.]

I have the honor to report the result of my experiment with German carp in a rice-field. I drained it to-day and cleared it of fish. The result is extraordinary as to growth of fish, but a failure as to numbers.

Last April I received from you 20 breeding fish. I had prepared the 10 acre field by filling up the main drains, except about 100 yards of one of them. I now believe this had better not be done, but that the fields should be left as they are for raising fish. Spawners should be provided for differently. The field had an ordinary rice field trunk, which I incased on the inner side with a frame 8 feet square, one side of which had galvanized wire screen with one-eighth of an inch mesh. The gate was so arranged as automatically to reduce the water 4 inches and refill twice a day. All the fish were supposed to be removed. In this pond the carp were put; but two of them were sick when received, and afterwards died. The growth of grass and water-plants in the pond was all that could be desired. A man was placed in charge of the field, whose duty was to keep off fish-hawks, cranes, snakes, &c., which are very plentiful here. Vast numbers of frogs found their way into the pond during the spawning season.

We found evidence during the summer of 6 large carp being destroyed, which, with the 2 previously mentioned as dying, would leave only 12 breeders; others might have been destroyed without our knowledge. During the spring hundreds of little fish were taken from the outside of the screen, where they had been killed by the force of the water pressing them against and into the screen. They were eels, trout, and that class of fish which abound in our waters.

During the summer we had a visitation of salt in our rivers, and not having full faith in your statement "that it would not injure carp, as they would adapt themselves to it," I was afraid to risk it, and so shut out all water. After three weeks a leak occurred in my trunk, and the water gradually left the pond until it was very low and became quite warm. The water still continued salt in the river, and I dared not use it. During this time numbers of beautiful fish were seen swimming in the drains, as the water was now in the drains alone, the surface of the field being uncovered. These, from their graceful appearance, I thought were carp. At this time a series of extra high tides set in, with a northeast wind, and the salt water, which I would not let in, came over the banks in such quantities as to make the little water remaining in the pond rather salt. If I had allowed the gate to continue taking in its usual flow on a full field, the salt, in all the time it continued, could not

have made the pond brackish. As it was, the schools of beautiful fish that I had thought were carp began to die, and these fish died by hundreds. They proved to be young menhaden, or a fish exactly like them. Other small fish died at the same time, and I took out a large number; but no fish that resembled a carp could be seen after the most careful observation. During this time one large carp jumped upon the bank at night and was not quite dead in the morning, but from its size I concluded it was one of the breeders. Fresh water was soon obtained and has been kept up until to-day, when I drew it off and obtained about one-half barrel of common fish—trout, gars, suckers, bream, perch, eels, flounders, crabs—and, to my great surprise, 73 large carp.

As they were being taken, I concluded that they were the breeders received from you, but when 12 had been taken out and still they kept coming of the same size I was confounded, as they all appeared larger than those you sent to me. I weighed 10 of them, with the following results:

Specimen.	Measurement from tip to tip.	Weight.	Specimen.	Measurement from tip to tip.	Weight.
	Inches.	*Lbs oz.*		*Inches.*	*Lbs. oz.*
First	16	2 5	Sixth	15	1 14
Second	17	2 10	Seventh	14	1 14
Third	16	2 5	Eighth	17	2 8
Fourth	15	1 14	Ninth	15	1 15
Fifth	15	1 14	Tenth	15	1 14

They were principally mirror carp; a few were full scaled; and one beautiful specimen was entirely free from scales. They are a beautiful lot of fish, but whether any of the original breeders are among them or not I cannot say.

Two things are demonstrated absolutely by these results:

1. That carp will live in warm shallow water, and will live in such water even if the same is largely impregnated with salt.

2. That rice-fields are pre-eminently adapted to the growth of carp. Here is a positive growth of 1 pound and 14 ounces in the smallest fish of the 73, which cannot possibly be more than 11 months old and may be only 7 months.* These fish are of such a size that even now they would readily sell as edible fish. If an acre of rice-field will sustain and perfect 1,000 of these fish annually, they would at 18 months old readily sell at 25 cents each. The failure with me has been in the propagation. If this difficulty could be overcome I see no reason why carp on rice-fields should not be a most important factor in the successful working of our rice lands, large bodies of which are now idle.

GEORGETOWN, S. C., *March* 24, 1885.

* Mr. Donaldson sent two specimens of these 30-ounce carp to Washington, and they have been placed in the National Museum (accession No. 15920). Should small propagating ponds be used for spawning the success of Mr. D. would be complete.—EDITOR.

84. EXAMINATION OF THE FISHERIES IN THE GULF OF MEXICO.

By SILAS STEARNS.

In the Gulf of Mexico an expedition should be at work the whole year in order to observe and investigate anything that might be important. The advantage of having a Gulf force entirely distinct from that of the Atlantic coast would be that it would be doing its most valuable work at the seasons when the latter would be needed at its stations, and also when most northern investigators would object to going to warm and sickly regions.

There would hardly be sufficient gain to compensate for the greater expense in having steam-power for a vessel engaged in this work, especially as the loss of time and the trouble in procuring fuel and in repairing machinery would probably bring the steamer to a level with a sailing-vessel. Nor would it seem advisable to employ a large vessel. The offshore work, such as beam-trawling, sounding, and the general fishing, is done mainly during the best weather, and could be done by a small vessel. Besides, a small schooner would do proportionately more than a vessel of several times her size, on account of her conveniences to handle. And then the schooner would be so much better adapted for duty in the bays and estuaries, by being able to carry the party and outfit to the near neighborhood of the oyster-beds, the bayous, and lagoons, and even into some of the rivers. It seems sufficient to say that the fishes of the Gulf coasts live mainly in shoal waters, and that if we are to study them in their element we must have a light-draft vessel to do so thoroughly. For the purpose I would select a center-board schooner of about 50 tons, which would draw but little water and have comfortable quarters for eight persons. Such a vessel, well equipped, would cost, new, about $5,000, and probably one could be bought for considerably less at second hand.

There is a schooner, named the Matchless, belonging to the Quartermaster's Department of the Army, now lying at the Pensacola navy-yard, which is soon to be sold to the highest bidder. She is of about 60 tons (new measurement), and is admirably adapted in every respect to the uses of the Fish Commission. Her draft is light (but 6 feet) and her accommodations are excellent. As she has been in constant use by the Army, her outfit is complete and in good condition. They sell her because there is no longer any duty requiring her at Dry Tortugas. Probably there will be but few bidders, and none prepared to pay more than $2,000. The monthly expenses of running a schooner of about 50 tons would be as follows: Mate, $50; cook, $40; four fishermen, at $25 each, $100; boy, $10; provisions, $150; chandlery bill, wear and tear, including also dockage and repairs, average, $75; total, $425. It would

also be desirable to have one or two young men, with some knowledge of natural history, to assist in the work of collecting and in keeping records of temperature, &c. With such an outfit work should be done entirely in the interests of the fishing industries, gathering information as to how they can best be protected and improved, &c.

I think that all intelligent persons who have followed closely the history of the fishing industries of the Gulf will agree with me that in almost every instance where a fishery has been pushed with any sort of vigor in a certain locality for several years the natural supply has been nearly exhausted. As instances of this I will mention the bay seine-fisheries of Galveston, Mobile, Pensacola, Choctawhatchee, Saint Andrew's, and Appalachicola Bays, and of the coast adjacent to Cedar Keys; the oyster fisheries of Mobile and Pensacola Bays and at several other points; the sponge and turtle fisheries about Cedar Keys and Key West; and also the red-snapper and grouper fisheries. All of these, by comparatively small demands upon them, have been quickly and surely reduced to less profitable and reliable conditions.

The shore bottom-fish, such as spotted trout, sheepshead, channel bass, mullet, and the large variety of smaller so-called "grass fish," have become so scarce along the Northern Gulf coast that they appear in small quantities in market only during a few weeks in the fall and spring, while but a few years ago they were abundant all winter, when there was an opportunity to send them to the interior. The grouper fishermen of Key West now have to go as far north as Cedar Keys to make a catch, and even then are twice as long on a trip as formerly. The Pensacola snapper fishermen are now obliged to sail 200 miles, and sometimes more, to the southeast to find any considerable quantity of fish, thus making the cost of the fish about one-third more than it was five years ago.

Most of the old fishing-grounds, which were large in extent and numerous, are nearly barren; but there are good red-snapper grounds south of the point now being fished over and reaching as far as Dry Tortugas. It is not practicable to extend the present voyages from Pensacola, and the product cannot reasonably be placed in the Western markets from any railroad connection south of Pensacola. As a consequence of the failure of these fisheries, at a time when the severe weather and ice prevents fishing on the Great Lakes and Western streams, the markets of a large part of the country that are beyond convenient reach of the Eastern Atlantic ports are but scantily supplied, and there is great clamoring for fish.

The migratory fishes, such as the pompano, bluefish, and Spanish mackerel, seem to be as abundant as formerly. They fluctuate in abundance, being rather scarce for a year or two and then returning even in larger quantities than ever. The present season has brought with it a larger run of Spanish mackerel than I have witnessed in nine years' experience. But these fishes generally come with the warm weather, when it has become impossible to send them in large quantities to the

interior, on account of the difficulty in transporting them in good condition to distant points, and because the Western markets are at the time glutted with cheaper fish from the Great Lakes. It would seem desirable to have some good fish, like the red snapper or striped bass, in such abundance during the winter months that the people of the South and West could depend upon a reasonably constant supply. The rapid exhaustion of the old red-snapper grounds leads me to believe that these fish are not holding their own against the inroads of man, and their habits and life history show that they cannot do so.

Aside from the work of ascertaining the best way to propagate Gulf fish, and of introducing new species there, the information so gained would be of value to the South Atlantic coast. The striped bass occurs in the Northern Gulf waters, but not abundantly. It is always in fine condition when captured, and is highly esteemed as food. Spawning adults and the young fish are occasionally taken. Besides trying to discover the best way to hatch the common native fishes and others, it would be well also to try to determine the results of the stocking with shad and salmon of the Southern rivers that empty into the Gulf. Probably an intelligent use of gill-nets at the mouths of these rivers at the proper season would be of value in that direction.

Any work of propagation done on the coast of Texas, or reliable information concerning the improvement of the fish supply of that State, would be heartily appreciated by a people who at present are in great need of good food-fish. While engaged in work of a practical nature, there would be opportunity for making large collections of specimens, and many things could be preserved that would be of scientific value to the National Museum, while a thorough study of the marine invertebrates would be of special value and interest, since so little has been done in that direction in these waters. The force at work would be qualified to make such collections. A small beam-trawl could be worked with good results, in the same manner as from the English sailing trawler; and if it was found advisable to have some hatching apparatus on board, there would be ample room for placing a small engine and hatching-jars.

PENSACOLA, FLA., *April* 20, 1885.

85.—PROPAGATION OF SALMON IN SALMON RIVER, OSWEGO COUNTY, NEW YORK.

By JOHN D. COLLINS.

I have been greatly interested in the spawning efforts of the *Salmo salar* in Salmon River for several years, and have wondered that the subject has not long ago attracted more attention. The following details are not upon personal knowledge, but were related to me by Mr. Cross, of Pulaski, N. Y., now deceased, who in his lifetime owned the

mill and dam there. The dam is 9 feet in height. My last conversation with him was about three years ago. I believe the information perfectly reliable.

Salmon River was long ago the spawning ground of salmon, up to the time this dam was built. The spearing of salmon was an important occupation of the residents all the way from near the mouth up as far as the High Falls (about 7 miles below the village of Redfield), a distance of some 25 or 30 miles by course of the river. This fall is a perpendicular drop of some 100 to 120 feet, and under it is a deep pool in the rocks of 200 or more feet in diameter. The stream is more or less rapid, varied with flat current; is crossed by the Rome, Watertown, and Ogdensburg Railroad at Sandy Bank, and probably at Pulaski. I think there is also a dam at Sand Bank. The water of the stream (a rather large one), as far as I have traveled it, is of exceeding clearness and transparency.

Mr. Cross about four or five years ago first informed me of the annual presence of salmon at his dam, and their efforts to get over it during the month of June; that their efforts were very persistent, and that some of the strongest males would even jump so as to go over it; also that annually many were caught in seines below the dam. I suggested to him that he should build a fishway, but it was found that the laws were so defective in respect to nets and seines that it was not expedient. In a later interview he told me it was proposed to cut a spillway or overflow around the dam, and that powder had been purchased for the blasting of rocks; still later that such a channel had been cut, and he thought a few had gone up it. This was about two years ago. Mr. Cross died soon after, and I have no later information.

From these facts it seems that this point is the only water in the State of New York where salmon have ever returned after their spawning places have been once broken up. I have supposed that this was on account of the fineness of the water, which in clearness would seem to resemble that of the Restigouche of Nova Scotia, where they abound. It would seem as if by a little public effort this stream could be reestablished as a spawning ground, especially by proper fishways and absolute protection for a year or two until once fairly established. To this end some special legislation would be required, among which would be the protection of *"black salmon" at all times, under severe penalties*, as in Canada. This salmon is a great protection to the spawning grounds.

The waters also of Fish Creek, in Lewis County, heading near those of Salmon River, were formerly the spawning ground of salmon, particularly at what is known as "Shaler's Hole," in the town of Lewis, but were broken up by many high dams on the streams. This stream empties into Lake Ontario through Oneida Lake. I hear of no attempts of salmon to ascend this stream, although it is possible.

UTICA, N. Y., *May* 22, 1885.

Vol. V, No. 19. Washington, D. C. Aug. 18, 1885.

86.—FISH-CULTURE AS A MEANS OF IMPROVING THE RACE OF FISH.*

By Baron VON K.

The principal object of all animal culture is the cheap production of food, but another object should be to produce the greatest possible quantity of meat in proportion to those parts which are either worthless or of little value for food. It should be the aim of the fish-culturist to produce races of fish having superior flesh.

There are two ways of reaching this end: (1) A sufficient supply of suitable food, furnishing enough food even beyond the actual need; and (2) the most careful selection for breeders of such animals as possess all the desired qualities in an especial degree. To provide a sufficient supply of suitable food presupposes an exact knowledge of the quantity of food and of its nutritious qualities needed at every age of the fish for its growth and development; therefore, the laying down of standard rules of feeding, such as, owing to the investigations of learned physiologists, have long since been laid down for our domestic animals. We still know but very little, and opinions are greatly divided, relative to the food which a fish needs for its life and growth.

It is true that endeavors are made by fish-culturists to raise the annual increase in the weight of fish to a certain desired point. But the experimental means are soon exhausted and the increase is but small. The question as to the food of fish should be studied all the more as artificial fish-culture tends to increase very largely the number of fish, which when left to nature are during the early period of their life exposed to a great many dangers. Although, owing to the depopulation of the waters, there is no present danger that they will become overstocked with fish, there is no doubt that sooner or later the fish will suffer from want of food, so that, in spite of all care and trouble, we would only get skeletons instead of plump fish, unless we find ways and means for procuring the necessary food or to increase the food at our disposal. We should not leave to nature and accident to furnish the necessary supply of food for the great mass of our fish. Pond-culturists especially should be prepared to stock their ponds with a larger number of fish than is the case at the present time; and they would by no means be certain of reaching this end by using some food which here and there, under different conditions, has answered the purpose. They must furnish to their fish food which their water does not contain in sufficient quantities and which they require at their different ages.

* "*Veredelnde Fischzucht.*" From the *Deutsche Fischerei-Zeitung*, Vol. IV, No. 4, Stettin, January 27, 1885. Translated from the German by HERMAN JACOBSON.

By means of long-continued observations of fish kept separate in aquariums, by trying different methods of feeding, and by chemical analyses of the various articles of food, we shall undoubtedly obtain satisfactory results. This is a line of investigation which would repay a physiologist for engaging in, and this is a branch of fish-culture where science can be employed to advantage. An attempt in this direction is the standard carp food prepared by Carl Nicklas in his well-known Manual of Pond-culture. This standard food is based too much on unreliable suppositions and on conclusions as to the correctness of which we entertain the gravest doubts; as, for example, when, in order to determine the necessary quantity of albumen, the hog is taken as a standard, because it is likewise omnivorous, which quality alone does not entitle us to draw a comparison between a mammal living on land and a fish living in the water.

Nicklas, however, deserves credit for having been the first to direct attention to the necessity of a rational system of feeding fish, and to lay down some standard rules therefor. By further and careful experiments his errors will probably be corrected. Although Nicklas states that by using fish-food prepared according to his rules he had obtained results perfectly satisfactory to himself, and although he accompanies his assertions by figures showing these results, he will doubtless agree with us that by using a method of feeding based on scientific investigations the results would have been much greater.

We desire to know what quantities of the different nutritive substances are needed, and what is the limit of food which should be exceeded, if a larger and superior race of fish is to be gradually produced. The proportion of nutritive substances composing fish-food should be very accurate. As is the case with other animals, the needs of fish change with age. During its early stages, when its framework of bones grows very considerably during the course of one year, it needs a different food from that required at a later period. All this can only be determined by means of exact scientific experiments. If we are prepared to give the fish food which is suitable in every respect, there is a reasonable prospect that we shall be successful in employing the second means for reaching the object in view, namely, the careful selection of breeders which are calculated to produce fish of superior flesh. In this respect it should first be determined what shape is most favorable to the development of flesh. In regard to this we prefer that framework of bones which is shortest in proportion to the size of the body, and the limited development of those parts which are worthless, such as the head, since the food can be given in small particles, and the tail and fins, because a well-cared-for pond fish need not be a particularly good swimmer. Care should also be taken not to lose the power of propagation in the endeavors to form flesh and fat. We also desire fish of rapid growth, so as to reach a good weight as soon as possible. The growth of fish varies very much when left to nature, and is furthered by a suf-

ficient supply of food rich in ashes. From among the well-formed fish we will therefore select those as breeders which develop quickest. The experience of stock-raising teaches that thereby we obtain a race of quickly growing animals. This quality is inherited, and is not easily lost, even when the animal for a short period is kept under less favorable conditions. An ample supply of proper food is therefore the first condition for producing better and more flesh, and only by satisfying this condition can artificial fish-culture prove a success in every sense of the word.

It is to be hoped that soon some physiologist may be found who will make earnest endeavors to fix the standard of food, which is still unknown. Surely friends and well-wishers of the fisheries will be found to furnish the necessary means for establishing an experimental station. The German Fishery Association will surely take as much interest in the rational raising of fish as in their numerical increase and in the introduction of foreign fish. The experience of stock-raising shows that it is not necessary to import animals from abroad as long as we adopt the principles followed by foreign raisers. The same applies to fish-culture. If our suggestions should lead to some action in this matter, we are certain that the numberless ponds in Germany which have been drained will again be filled with water and be restored to their original purpose, and that large quantities of fish-flesh will be brought into the market, of a quality which at present is rarely seen on our tables.

87.—A MUD SLOUGH ON THE GRAND BANKS.

By Capt. GEORGE A. JOHNSON.

[Communicated by the Hydrographic Office, U. S. Navy.]

The opening is to the eastward and the trend of the slough is NW. by N. (p. c.). The lower point of the opening is in latitude 44° N., longitude 49° 12′ W.; the upper point is 7 miles to the northward of this position. At the lower point is a depth of 128 fathoms and at the northern 45 fathoms. In the center of the slough no bottom was obtained at 300 fathoms, and at one point along the northern edge bottom was obtained at 150 fathoms. From a point about half way the length of the slough, on its southern side, the vessel dragged in a NE. direction between 6 and 7 miles, with anchor down and 150 fathoms of chain out, until it brought up at the point on the northern edge somewhat beyond the point referred to above as having a depth of 150 fathoms. Along the edge of the bank the current runs about SSW., while in this slough the water is nearly dead, what little current there is being in some places just the opposite of what it is along the eastern edge of the bank,

From the opening to the NW. edge of the slough is nearly 10 miles, and at no point inside it do the soundings agree with those given on either our own or the English charts, but a French chart shows something like this pocket.

The slough is wider across the center than at the opening. The position given is one determined by three persons, each of whom had his own chronometer, and the three positions differed but little over half a mile. The one given is the mean.

There is a similar pocket off Sable Island, with the opening to the southward, which is 5 miles across and in which soundings have been found at a depth of 350 fathoms.

This pocket is of the same character as the one described, but only one position has been observed, which is latitude 43° 17′ N., longitude 61° 8′ W. There are several of these pockets on the Banks which are known to the fishermen of Gloucester, as they go to them for halibut.

SCHOONER AUGUSTA H. JOHNSON, *Gloucester, Mass., July*, 1885.

88.—THE PEARL FISHERIES OF TAHITI.

By BOUCHON-BRANDELY.

[Abstract from Official Journal.]

The author was sent by the Ministry of Marine and the Colonies on a mission to Tahiti to study questions relating to oyster culture there. The principal product of what Brandely, with "the summer isles of Eden" fresh in his mind, calls "*notre belle et si poétique colonie de Taiti*" is mother-of-pearl. All its trade is due solely to this article, which for a century has regularly attracted vessels to the islands which compose the archipelagoes of Tuamotu, Gambier, and Tubai. The mother-of-pearl which is employed in industry, and especially in French industry, is furnished by various kinds of shells, the most estimated, variegated, and beautiful of which are those of the pearl-oyster. There are two kinds of pearl-oysters; one, known under the name of pintadine (*Meleagrina margaritifera*) is found in China, India, the Red Sea, the Comoro Islands, Northeastern Australia, the Gulf of Mexico, and especially in the Tuamotu and Gambier archipelagoes; the other, more commonly called the pearl-oyster (*Meleagrina radiata*), comes from India, the China Seas, the Antilles, the Red Sea, and Northern Australia. The shell of the former is harder, more tinted, more transparent, and reaches greater dimensions than the latter. Some have been found which have measured 30 centimeters in diameter and weighed more than 10 kilograms, while the *Meleagrina radiata* rarely exceeds 10 centimeters at the most, and never weighs as much as 150 grams. Both varieties supply pearls, those of one kind being at one time more favored, at another time those of the other. This depends on fashion; but, on the whole, those found in the

great pintadine are more beautiful, and the color more transparent, than those of its congener.

The amount of the trade from Tahiti in pearls cannot be stated with accuracy, as there is much clandestine traffic (approximately 300,000 francs), England, Germany, and the United States being the chief markets for the fine pearls. The great pintadine is found in great abundance in the Tuamotu and Gambier Islands. The situation there is very favorable for them; in the clear and limpid waters of the lagoons they have full freedom for development, and are undisturbed by storms. Mother-of-pearl is found in almost every one of the eighty islands which form the archipelagoes Tuamotu and Gambier. These belong to France, having been annexed at the same time as Tahiti and Moorea, and have a population of about 5,000 people, all belonging to the Maori race. Brandely gives an interesting description of these little-known islands and people. The latter appear to hover always on the brink of starvation, as the islands, which are composed mainly of coral sand, produce hardly anything of a vegetable nature. While the neighboring Society Islanders have everything without labor and in abundance, the unfortunate inhabitant of Tuamotu is forced to support existence with cocoanuts, almost the only fruit-trees which will grow on the sandy beach, with fish and shell-fish which are poisonous for several months of the year, and often they have to kill their dogs for want of other animal food. There are no birds, except the usual sea-birds; no quadrupeds, except those brought by man; no food resources necessary to European life, except what is brought by ships. Although the people are gentle and hospitable, they practice cannibalism. It is pitiless hunger alone which has driven them into this horrible custom.

These people are the chief pearl-divers of the Pacific; indeed it is their only industry, and women and even children take part in it. There is at Anaa, says the writer, a woman who will go down 25 fathoms, and remain under water for three minutes. Nor was she an exception. The dangers of the work are great, for the depths of the lagoons are infested by sharks, against which the divers, being unable to escape, are forced to wage battle, in which life is the stake. No year passes without some disaster from sharks, and when one happens all the divers are seized with terror, and the fishing is stopped for a time. But gradually the imperious wants of life drive them back to the sea again, for mother-of-pearl is the current coin of Tuamotu. With it the native buys the rags which cover him, the little bread and flour which complete his food, and alcohol, "that fatal present of civilization," for which he exhibits a pronounced passion.

Some twenty-five or thirty years ago the trade in mother-of-pearl in the Tuamotu archipelago was very profitable for those engaged in it. For a valueless piece of cloth, a few handfuls of flour, or some rum, the traders got half a ton of mother-of-pearl, worth 1,000 or 2,000 francs, or even fine pearls of which the natives did not

know the value. The archipelagoes were frequented by vessels of all nationalities; mother-of-pearl was abundant, and pearls were less rare than they are now. The number of trading ships increased; there was competition among them, and consequently a higher price to the natives, who fished to meet the new demand with improvident ardor. The consequence is that the lagoons are less productive, and that even the most fertile give manifest signs of exhaustion. The prospect of having the inhabitants of Tuamotu thrown on its hands in a state of helpless destitution, as well as of the disappearance of the principle article of the trade of Tahiti, and an important source of revenue to the colony, alarmed the colonial administration and the ministry of marine and the colonies in Paris. Accordingly Brandely was selected to study the whole subject on the spot. The points to which he was instructed to direct special attention were these: (1) The actual state of the lagoons which produce oysters; are they beginning to be impoverished, and, if so, what is the cause, and what the remedy? (2) Would it be possible to create at Tuamotu, Gambier, Tahiti, and Moorea, for the cultivation of mother-of-pearl, an industry analagous to that existing in France for edible oysters? Would it be possible by this means to supply the natives of Tuamotu with continuous, fixed, remunerative labor, which would render them independent, and remove them from the shameless cupidity of the traders? Could they not be spared the hardships and dangers resulting from the continued practice of diving, and be turned to more fixed sedentary modes of life, by which they might be raised gradually in the social scale? (3) Should the pearl fishing in the archipelagoes be regulated, and, if so, what should be the bases of such regulations? It was on the mixed economical and philanthropic mission here indicated that Brandely went to Tahiti in February last. The statistics tics did not show any decline in the production of mother-of-pearl, but a careful study on the spot showed that this was due to the great amount of the clandestine traffic, and that the lagoons were growing less productive day by day; that beautiful mother-of-pearl was becoming rarer, and in order nowadays to get oysters of a marketable size the divers are forced to go to even greater depths. Brandely recommends prompt and vigorous measures be taken at once, or the lagoons of Tuamotu will soon be ruined forever. The partial steps already adopted have been useless. The total prohibition of fishing in some of the islands for several years has failed, because it has been found that the pintadine is hermaphrodite, and not, as formerly was believed, unisexual. The cause of the impoverishment of the lagoons is excessive fishing, and nothing else. He thinks that it is possible to create in Tuamotu, Gambier, Tahiti, and Moorea a rational and methodical cultivation of mother-of-pearl oysters, analogous to that existing with regard to edible oysters on the French coasts, and to constitute for the profit of the colony an industrial monopoly which no other country can dispute, for nowhere else can such favorable conditions be found.

89.—SOME FACTS CONCERNING ISINGLASS.*

By HENRIK KNUDSEN.

It is probably well known that one of the most important qualities of common glue is that it can gelatinate. As regards this property of gelatinating, isinglass prepared from fish-skins and heads differs very materially from common glue, as it will but rarely, and only under certain conditions, form an incomplete jelly, which, during the succeeding drying process, at a heat of 8° Celsius, will again become fluid or dissolve, which prevents its being formed in tablets like the common glue. It must therefore be considered as a characteristic quality of isinglass that it does not easily turn to jelly, but that when strongly concentrated, and at a low temperature, will stiffen so as to form a tough mass.

The usual process of preparing isinglass is as follows: When fresh, the air-bladder is taken from the back of the fish by striking the fish several blows with a wooden club, whereby the sound is loosened, after which it is torn from the back and cut open lengthwise, so that it is freed from any bones which may adhere to it. It is then placed in cold water—sometimes in lime-water—where it remains some time. It is then carefully cleaned of all blood, and the black outer skin is removed with a knife; whereupon it is again washed in fresh water, and spread out on a board to dry in the open air, the inner shining skin being turned outside. To prevent the sound from shriveling during the drying process, whereby it would lose its smoothness, it should at once be fastened to the drying-board by small pegs or tacks. For obtaining a good article of isinglass it is considered absolutely necessary that the sound should be dried in the sun; and for this reason swims cleaned in winter are kept under the snow till spring. After the drying process is finished the sound is again moistened by drawing over it a brush dipped in warm water, whereupon the inner shining skin is removed by hammering or rubbing. Finally it is rolled between two polished iron rollers.

Isinglass which is to be made into gelatine, before undergoing the above-mentioned processes and while still in a moist condition, is bleached in a solution of sulphuric acid, in which it swells up to a colorless jelly, which, after having been dissolved in warm water and after the jelly formed in cooling has become dry, will make a clear and colorless gelatine.

To avoid the drying process, which cannot very well be done in winter and during the busy fishing season, the sounds are salted and sold in

* "*Lidt om Fiskelim.*" From *Fiskeritidende*, No. 23, Copenhagen, June 9, 1885. Translated from the Danish by HERMAN JACOBSON.

that condition. It should be stated, however, that before being salted they should be cleaned very thoroughly, as it is very difficult to remove blood and muscle-tissue from a salted swim. Cleaned sounds, of course, sell much higher, and they are far preferable in every respect to those which have not been cleaned. The most troublesome and time-consuming work in the preparation of isinglass is to remove the sound from the backbone, which is still done by hand. This is also the principal reason why more general use has not yet been made of the sounds. This work must be done very slowly, and to produce large amounts of isinglass would require much labor, which is hard to obtain during the fishing season. If it was possible to use for this work some sort of machine which would meet all the requirements, the manufacture of isinglass would receive a new impetus.

Good isinglass should be of a bright (or at least a light yellow) color, thin and transparent, and without any odor or taste, which will invariably indicate the presence of impurities. When dissolved in boiling water (in cold water it does not dissolve, but merely turns to a clear jelly) there should remain but a very small insoluble residue, and the jelly which is formed should be clear and colorless.

A great portion of the isinglass which is at present brought into the market comes from North America. Like the Norwegian fish-glue, it is prepared from the air-bladders of cod, and does not easily dissolve in water, and a greater quantity remains undissolved than in the Russian isinglass. The method of preparing it is like the one described above, only with this difference, that immediately after having been cleaned, while still in a moist condition, it is pressed between iron rollers, after which it is spread out and dried in the sun. America has of late years made rapid progress in the manufacture of isinglass from fish refuse. The raw material consists to some extent of fish-heads, and especially of fish-skins—the waste products of "boneless fish." The skins are soaked and washed in order to remove salt and all impurities and to prepare them for the following bleaching process, when the isinglass is obtained by boiling them in water, and by clearing the liquid glue and concentrating it in vacuum-pans. Entirely pure liquid fish-glue is colorless, and, like the pure isinglass, has neither odor nor taste.

The light and most strongly concentrated fish-glue is used in the manufacture of pianos and various kinds of wooden ware; a light and less concentrated grade is used in the manufacture of paper; and a dark and highly concentrated grade is used in the manufacture of hats and shoes.

Sweden occupies a prominent place among the countries producing isinglass. Manufacturers in Lysekil have sent us excellent specimens of dried isinglass in thick but clear tablets, having a slight yellowish tinge, and gelatine in thin tablets, clear as water. We have been informed that these articles have been specially prepared from sounds that had first been subjected to a bleaching process, after which they

were dissolved in warm water whose temperature varied between 30° and 60° Celsius. The dissolving process takes place in wooden vessels with hair bottoms, and surrounded by poor heat conductors. After having been allowed to stand in these vessels for twenty-four hours the solution of glue, which is still warm, is drawn off and placed in smaller wooden vessels to cool, when it forms a clear and colorless jelly, which is cut into tablets and dried on nets stretched out on frames, as is done with the common cabinet-makers' glue.

90.—SPAWNING OF SPRING HERRING NEAR NORWAY.*

By S. A. BUCH.

[From report to the Norwegian Department of the Interior, 1884.]

As early as December 7, 1883, some specimens of herring were sent to me from Ekersund. The 10 specimens which I examined were all spring herring. The sexual organs, whose average weight was 37.05 grams, were not yet developed; so that it was not improbable that considerable time would elapse before the herring would come close to the coast. To judge from the specimens which I received, the majority of these fish were females.

Ten days later I received some specimens from Skudesnæs, but they consisted exclusively of so-called "blood-herring," which do not at this time visit our coast for the purpose of spawning.

On December 22 I received from Frederikshald 24 "Hvalöer herring," which were said to be genuine average specimens of a large quantity of herring caught in nets. Of these 24 herring 20 were of different age, and but very few were ready to spawn. Only 4 were spring herring, and had well-developed sexual organs (average weight 40.1 grams), which certainly were somewhat larger than those of the "Ekeröe herring;" nevertheless these herring were by no means ready to spawn. Of these herring 14 were females and 10 males.

On December 24 some herring came from the Hvitings Islands. The average weight of the sexual organs was 47.17 grams, but they were not fully developed, although more so than those which I had received previously.

The herring which I had occasion to examine later I received between February 1 and the middle of March. On February 1 I received 5 specimens from Rövær, all small herring, still firm and full. One was a "blood-herring," and the rest spring herring, whose sexual organs had an average weight of 25.75 grams.

On February 5 herring that were ready to spawn were this year found for the first time near Utsire. Some of the females had even cast some

* "*Vaarsildens Gydning.*" Translated from the Danish by HERMAN JACOBSON.

spawn, but this had probably been caused by their having been chased and scared by codfish, an occurrence which seems quite common during the early part of the fisheries. Fifty-three per cent of the herring which I examined were males, and 47 per cent were females. The average weight of the sexual organs was 46.6 grams. The temperature of the water varied from 5°.9 to 6°.3 Celsius.

On February 6 and 7 all the herring caught on the coast near Utsire were full of spawn, which, however, was loose. The temperature of the water on February 6, from the surface to the depth of 70 meters, varied from 5°.9 to 6° and on the 7th at the same depth from 5°.9 to 6°.3 Celsius.

On February 8, 63 per cent of the herring which I received were females and 37 per cent males; and on the 9th 71 per cent females and 29 per cent males. On both days the herring were full of spawn, all of which was loose.

On February 14 I received about 30 codfish, caught at a depth of 120 meters northeast of Nordvaag. The contents of their stomachs consisted in all cases of herring spawn, which, as the embryo was scarcely visible, must have been ejected by the herring during the days immediately preceding February 14.

On February 16 I found spawn, while scraping the bottom near Nordvaag, and lines hauled in the same day were covered with spawn. On the 15th the temperature, at a depth of from 0 to 70 meters, varied between 5°.2 and 5°.6 Celsius, and on the 16th, at the same depth, from 5° to 5°.4.

On February 19 it was observed for the first time this season that herring had spawned in shallow water near Urter; and on the 20th, 21st, and 22d the herring had literally whitened the sea all round Urter. By bottom-scraping some days later great masses of roe were brought to the surface round the Sveaboerne Islands (north of Urter), and between these islands and Urter. Near Urter herring spawn could be found in every sound and bay, from the surface down to a depth of 40 or 50 meters. The temperature of the water near Urter, at a depth of from 0 to 70 meters, during these days varied between 4°.9 and 5°.3 Celsius.

On February 21st 41 per cent of the herring which I received were females and 59 per cent were males; on the 22d 42 per cent females and 58 per cent males; and on the 23d there were among the herring caught near Kalstöe 54 per cent males and 46 per cent females. In average years it is the rule that in the beginning of the fisheries the female herring are in the majority, and only after the fisheries have progressed for some time is this reversed. But this year it was observed as early as February 15, therefore at a time when spawning had just commenced, that the male herring were much more numerous than the females; and this remained so during the rest of the fishing season.

On February 25 the herring spawned near Kvittingerne, and near

Kvalevaag and Salvöe. All the lines were thickly covered with spawn, both in deep and in shallow water. On this day the temperature, at a depth of from 0 to 50 meters, varied from 5° to 5°.4 Celsius. The male fish were, on the whole, still full, and only in exceptional cases a few had ejected a small quantity of milt. In three batches of herring received by me at different hours during the day, the percentage of males was 75, 73, and 72, respectively.

On February 26 I examined the coast from the Ferkingstad Islands as far as Akrehavn and Kvalevaag. In nearly all places where the bottom was clean (covered with coarse and fine sand) the herring had spawned at a depth varying from 10 to 60 meters. Among the number of herring which I examined the males were invariably in the majority. On the 26th the temperature at a depth of from 0 to 70 meters varied between 4°.6 and 5° Celsius.

On March 1 the herring had "whitened" the sea near Sværdholm, the most southerly point in the southern district where spawning was observed during this year's fishing season. The temperature at Veavaag (1¼ Danish miles north of Sværdholm) varied between 4°.4 and 5° Celsius at a depth of from 0 to 30 meters.

During the following days I had occasion daily to examine codfish caught between the Ferkingstad Islands and Kvalevaag. As nearly each of these codfish was full, almost to repletion, of herring spawn, and as bottom-scraping invariably brought to the surface a great quantity of spawn, I was confirmed in my opinion that the herring had spawned over a vast area, which from the last herring period was known as a good spawning place. That the herring have spawned successively, and have stayed in this place for some time, is also proved by the circumstance that in the stomach of one cod there were found herring eggs in all stages of development, from recently impregnated spawn to spawn where the shining metal colored iris of the embryo could be seen with the naked eye.

About March 6 and 7 the spawning process may be said to have ceased in the southern part of the southern district. Near Stokvigen, Grotlefiord, and in the neighborhood of Hisken and Haapollen spawning herring were observed as late as the middle of March. Herring caught on March 21 were found to have finished spawning. During the period from March 10 to 15, the temperature of the water at a depth of from 0 to 70 meters varied from 3°.5 to 4°.7 Celsius between Nökling and Brandesund.

It will be seen that all the spawning observed in the southern part of the district took place from the surface to a depth of 70 meters, and at a temperature of the water varying from 4°.4 to 6° Celsius, while in the northern part of the district, at the same depth, it took place at a temperature varying from 3°.5 to 4°.7 Celsius.

According to my instructions, I was to place impregnated herring spawn in an inclosed basin. I was fortunate enough to find a suitable

locality at Salvöe and Tvilanparholmerne, on the west side of the island of Karmöe. I found, however, that in view of the investigations to be made, it would be of special interest to have these basins stocked with live spring herring, so as to be able to follow the development of the sexual organs until the following year, and, if possible, to throw some more light on the nature and development of the so-called "blood-herring." For this purpose each of the basins was stocked with 500 herring; and among those in the Tvilanpar basin there were some "blood-herring." In one of the walls of the Tvilanpar basin I had an iron grating inserted, so that constant connection with the sea was maintained and the herring were prevented from slipping out. To furnish the herring in this basin with food I placed in it a large number of lobsters with roe, so that the newly-hatched young lobsters might supply food for the herring during summer. In the Salvöe basin the conditions were such as to make it unnecessary to have special connection with the sea, as there is a regular connection at every tide, which, however, does not cause the water to rise so high that the herring could slip out.

During the course of spring and summer I had many opportunities for observing the herring. In April they were lean, and looked in every respect as if they had been starved. In May they had recovered somewhat, and in June they had become so fat that the common people called them "pretty" herring. But the circumstance which was of the greatest interest to me was that on June 20 I found among 10 herring taken from the Tvilanpar basin 2 (a male and a female) full of milt and spawn and almost ready to spawn. It would, of course, be somewhat premature to base on this single instance a theory as to the development of the so called "blood-herring;" but the fact is nevertheless one of great interest, and I deem it proper to make it known. I cannot force myself to believe that these two specimens should belong to the spring herring; but I am rather inclined to the opinion that they belong to the "blood-herring;" and the conclusion which might naturally be drawn therefrom would be that the "blood-herring" belong to those herring which spawn in summer and autumn, which are found in the shallow portions of the North Sea, and which during July and August are, in enormous numbers, caught by the Dutch and Scotch fishermen.

I am convinced that if the investigations relative to herring are to lead to any practical result they should not be made in winter alone; but that the places where the spring herring stay during summer should be sought, and that the winter investigations should be continued during summer and autumn between Norway, the Shetland Islands, and Iceland. For several years I have endeavored to establish seine fisheries on a rational basis in the North Sea, and thus to provide a new source of income for our coast population. I am of opinion that such summer and autumn seine fisheries would be the first practical result of the investigations referred to above, while at the same time our knowledge of the natural history of the herring would be considerably increased.

91.—THE ICELAND SHARK-FISHERIES.*

The kind of shark which is called in Danish *harkal* (Greenland shark, *Scymnus microcephalus*) is found throughout the entire Arctic Ocean, near Greenland and Iceland, and, though in smaller numbers, in the North Sea, and even in the Cattegat, where nearly every year some are caught near the coast of Bohuslän, and on the so-called "Great Banks," where the depth is from 30 to 110 fathoms. In Norway important shark-fisheries have been carried on from time immemorial, particularly in winter, from the beginning of September to the end of February, from Tromsöe to the Varanger fiord, and in some other places, such as Storeggen, on the coast of Romsdal. Most of these fishing places have a depth of from 100 to 300 fathoms, and are generally at the distance of several miles from the land. Many Norwegian vessels also catch sharks in the Arctic Ocean between Beeren (Iceland) and Spitzbergen, where these fish are called *haakjærring*. On the Danish coasts the shark is very rare. Occasionally some have been seen as far south as the Kullen promontory, at the northern entrance of the Sound; near Hou, in the Cattegat; and near Sonder-Nissum, on the west coast of Jutland. There are, therefore, on the Danish coasts no regular shark-fisheries.

There seems to prevail some uncertainty as to the size of the Greenland shark; near Iceland, for instance, it is said to reach the length of 24 feet. This statement is probably based on the account of Gunnerus. There has certainly been some misunderstanding as regards a statement made by Eggert Olafson, who says, "The largest Greenland shark can reach the length of 10 yards, Iceland measure." A yard, Iceland measure, however, is 18 inches, and according to Danish measure, this would be only 7½ Danish yards. We shall be about right when we say that the size of the Greenland shark rarely exceeds 6 Danish yards, or 12 feet. Lieut. C. Trolle states that he caught one measuring 23 feet in length.

The Greenland shark is caught principally on account of its liver, but in Iceland the meat is also frequently used as food, after it has been allowed to hang for some time, or, having been put in the ground, has undergone a process of fermentation. When fresh the meat is indigestible and unwholesome; when dried it has a peculiar but by no means disagreeable flavor, somewhat resembling old cheese. When fermented the meat is slimy and jelly-like, but it is stated that at present it is not much used for food when in that condition. The yield of oil, of course, differs very much, according to the size of the liver, which corresponds to the size and fatness of the fish. A good liver will yield about 66 per cent oil, while others will only yield about 50

* "*Havkalfangsten fra Island.*" From *Fiskeritidende*, No. 46, Copenhagen, November 11, 1884. Translated from the Danish by HERMAN JACOBSON.

per cent. The data relative to the average yield of oil from the liver of the Greenland shark vary greatly. When a Norwegian writer states that a single large Greenland shark yielded 7 hectoliters [about 185 gallons] of oil, this must be of course an exaggeration; but other data, which make the yield of the shark's liver from one-fifth hectoliter to 3 hectoliters, will not give us a correct idea either, as a shark having 2 barrels [a "barrel," as used in this article, contains about 44 gallons] of liver will always be a very large fish. Kröyer gives the average yield of a liver as 120 *potter* [1 *pot* equals 1 quart, about]; while Rosted says that 1½ barrels of fat liver will produce a barrel of oil, therefore 160 *potter* will be obtained from 2 barrels of liver. In Iceland the livers are not counted, but measured with a peculiar Iceland measure, the *kútur*. On the west coast of Iceland, 18 *kúturs* of liver make a barrel, and at Ofiord 15 *kúturs* make a barrel. At present one generally calculates on getting from one barrel of liver three-fifths of a barrel of oil, therefore about the same quantity as given by Rosted. It should be remembered, however, that at present much greater care is taken in extracting the oil from the livers, that the apparatus has been greatly improved, and that steam is frequently employed.

In 1884 the shark fisheries near Iceland were exceedingly productive. On the west coast not a single vessel got less than 600 barrels of liver during a period of six months. The price was about $6.70 per barrel of liver and $11.25 per barrel of oil.

The fisheries are carried on partly with open boats, which are principally used in the Faxe Bay and in the Isa fiord. In the southern part of the Faxe Bay the fisheries with open boats do not amount to much, but some such fisheries are carried on in the other parts of the bay, while extensive open-boat fisheries are carried on in the western fiords, in the Stranda district and on the coast of Nordland. Fisheries with open boats are, of course, carried on in winter, when the fish come near the coast. These fisheries, however, are connected with many dangers, and many boats are lost. If the circumstances would allow it, or if the fishermen had the necessary means, they would certainly get larger vessels. Here is a chance for the Iceland Government to do a good work by advancing some money to the poor fishermen, so that they could buy sea-going vessels. The tonnage of the schooners used on the west coast of Iceland from the Brede Bay to the Isa fiord, varies from 20 to 85 tons (costing from $2,680 to $6,332); and the total number of these schooners is about 30. There seems now to be a tendency to employ small vessels of from 20 to 30 tons, because the larger vessels require three times as expensive apparatus.

The fishing season generally extends from January to August. In winter the Greenland shark keeps in shallower water than in summer (in from 40 to 50 fathoms); and the young sharks go in still shallower water and within a few miles of the coast, while in summer the sharks must be sought at a distance of 20 [Danish?] miles from the coast, and

at a depth of from 200 to 300 fathoms. In August they are found at a depth of 100 fathoms, and in September at from 40 to 50 fathoms. On the west coast the fishing season lasts from April to September, and the outfit costs from $1,340 to $1,608. A single line generally measures 120 fathoms in length; sometimes three lines are tied together. To the line is fastened the weight (weighing from 8 to 10 pounds), and underneath this there are 4 feet of a small chain, which runs in a swivel on the hook, which is about 10 or 12 inches long, the distance between the point and the main part of hook being 3 or 4 inches. The line is carried out over a block whose disk must fit exactly, so that the line does not get between. The block is open at the top, and has a bolt which can be fastened to the railing.

As soon as the fishing place has been reached the boats cast anchor. The anchor generally weighs from 112 to 160 pounds, and has 15 or 16 fathoms of chain attached to it as a protection. A deep trough or valley at the bottom of the sea with muddy or light-clay bottom is the favorite haunt of the Greenland shark. From this trough they like to go along the slopes of the valley and into shallower water to seek food, and to return again to the depths. The Greenland shark is said to scent its prey at a long distance, and the fishermen say that it will go a long way for its food. After a vessel has cast anchor it may sometimes lie for some time before sharks will approach and bite. The small fish generally come first, and are followed by the larger and fatter fish, whose appearance marks the approaching end of the fisheries.

For bait seal-fat and horse-flesh are used. Horse-flesh should first be kept for some time in a mixture of blood and salt until it is half decayed. Smoked horse-flesh and young seals, kept in spirits of wine, are also used for bait. The hook should be entirely hid by meat and fat. During a fishing season there are used on an average 1½ barrels of meat, 1 barrel of seal-fat, and 2 or 3 young seals. These are cut in pieces, and these separate pieces may, of course, be used several times. A single seal-head has occasionally been instrumental in catching enough fish to yield 20 or 30 barrels of liver.

When the weight has reached the bottom, a few fathoms of the line are hauled in, holding it firmly outside the block, so that one can notice readily when a shark is beginning to play round the hook. A piece of the line is then slowly hauled in and let go again, thus enticing the shark to seize the hook and get caught. It is easy enough to haul in the fish, for it offers no other resistance than to turn round; but this does not interfere with the hauling in, as the hook will turn on its swivel. As soon as the fish has been brought to the surface of the water, a knife with a long handle and a blade about 2 feet long is driven into its back; after the knife has been firmly inserted in the body of the fish, the head is raised high enough to insert a large iron hook, instead of the pieces of chain used in former times. Some ten years ago the fish were attached to the vessel by means of chains, while now they are

allowed to drift after the liver has been cut out. The liver is cut to pieces in the water; and the pieces are taken up with a dipper and placed in a barrel with a perforated bottom, so that the water and blood can flow off. The livers are then packed in boxes or placed loose in a compartment of the hold.

On the west coast of Iceland a shark vessel has generally a crew of 8 men, beside the captain. The crew of the Ofiord vessels generally numbers 10 or 12 men. Three or four hooks are used at the same time, but when the fish bite well fewer hooks are used.

On the coast of Nordland the fishermen share the profits, while in Vestland the fishermen hire themselves out to owners of vessels. The captain of the vessel then gets $4.28 per week, the mate $3.21, and the sailors (or fishermen) from $2.14 to $2.68 each. A premium, moreover, is paid for every barrel of liver, namely, 53 cents to the captain, 26 cents to the mate, and about 13 or 14 cents to each fisherman. When the fisheries are conducted on the share system the liver is (for 9 men) divided into eighteen parts. The owner of the vessel gets one-half, but he pays extra for one part for the captain, who therefore gets two parts. Frequently, however, different arrangements are made among the persons engaged and having a share in the fisheries.

The crew receive the following rations per week for each man: Six pounds bread, 2 pounds butter, 3 pounds meat, ½ pound coffee, and ½ pound rock candy. For each trip (lasting about one month) each vessel is furnished with 20 quarts of brandy, a half-barrel of peas or rice, a proportionate quantity of sugar or molasses, and 2 barrels of coal.

After the close of the shark fisheries the vessels are either laid up or employed in other fisheries. In the Ofiord there is an insurance company for these vessels, which has done a great deal of good.

92.—ABUNDANCE OF FISH IN THE GULF OF MEXICO.

By L. H. SELLARS.

[Letter to Prof. S. F. Baird.]

In 1881 the fish came on this coast in such numbers that the Pensacola Ice Company bought a steamer with intent to purse-seine them. From that time till now there have but few fish come north of Cape San Blas. This year there is a glut, and it seems that the Atlantic markets are full also. Lake fish are shipped to points contiguous to here. Even the deep-sea fish, such as snappers and groupers, are more abundant, and bite at the hook more freely.

Now, is there any meteorological phenomenon upon which to base this superabundance of fish? We have been noticing the catching of fish many years, but can see no reasons for this irregular periodical rush of fish from their hiding-places to the coast.

PENSACOLA, FLA., *May* 4, 1885.

Vol. V, No. 20. Washington, D. C. Aug. 21, 1885.

93.—FOOD OF MACKEREL, PILCHARDS, AND HERRING.

By MATTHIAS DUNN.

[From Land and Water.]

For a period of more than twenty years I have noticed that the whole surface of the sea off our coasts here, in the spring months of the year, at certain times assumes a deep olive color, and I have had opportunities for knowing that in favorable seasons this color is to be found stretching out full 20 miles from land. Our fishermen here call it "cowshiny" water, no doubt because of the similarity which exists between the sea at such times and the excrement of the cow when mixed with water.

Every inquiry into the matter left me without a clue as to its cause, but on looking carefully into the sea, I found it full of olive-colored forms, which for a considerable time I thought were small medusas, but under the glass it was seen they were not medusas, but globules of olive matter, varying in size from ordinary gunshot to that of small garden peas. When I had opportunities of noting them, I found they permeated the water for many yards in depth, and their number was as incalculable as that of the sands on the sea-shore.

On further observation it was noted that all our surface-feeding fishes were exceedingly fond of them as food, and that the stomachs of the mackerel, herring, and pilchards were often found distended with them. And, moreover, that the success of the inshore mackerel-fishery on our coasts in the months of March and April depended on their presence.

After considerable investigation into the matter, and comparing the undeveloped with the developed spores, I believe I am safe in saying that all these untold myriads of olive globules in our seas, which furnish such abundance of food for the fishes, which color the sea to a considerable depth, and which stretch out so many miles from the land, are nothing more than the fully developed seeds or spores of the *Melanospermeæ*, or olive seaweeds.

The number of spores thrown off by a single plant in one season is prodigious. The last I observed was a *Fusis serratus*, and the figures to represent them would be not less than two millions. The few books I have on the weeds make no remarks on rain-water playing any part in the development of the spores. But it now seems probable that there can be no fructification of the spores of the olive and green seaweeds without the genial showers of the spring and the summer.

April 18, 1885.

94.—EELS AND EELPOTS IN NORWAY.*

Every one who has carried on eel-fisheries with eelpots knows that he must get up early in the morning to take up the eelpots, as otherwise the eels slip out again. In order to prevent this, John Knudsen placed in the upper side of the eelpot a movable door or lid, which opens inside by the least pressure of the eel against it, and closes again by its own weight after the eel has passed through the opening. This lid is made of the same material as the eelpot, namely, of thin willow branches, and the necessary weight is given to it by pieces of lead rolled round the branches. The principle is not new, but is applied in different kinds of traps used for catching land animals. Among fishing apparatus used in the water it is applied in DeCaux's lobster-trap.

Comparative experiments were made near Tysnæs last summer in order to test Knudsen's eelpot and the one generally employed. The two kinds of eelpots were placed side by side and supplied with the same kind of bait. During one of these experiments the eelpots were left untouched for two days, and when taken up Knudsen's eelpot contained thirty-seven eels, while the other was empty. One of the advantages of Knudsen's eelpot is this, that it will catch eels of any size, while large eels do not go into the common eelpots, because the branches composing the neck are pretty close together, making it difficult for a good-sized eel to squeeze through. Large eels, therefore, keep out of these eelpots. Knudsen has received a premium of 50 crowns [$13.40] for the model of his eelpot from the Society for the Promotion of the Norwegian Fisheries, so that it became the property of this society.

Of late years small quantities of salted eels have been shipped from Norway to Hamburg, where they are smoked. Before the eels are salted, as much as possible of the slime adhering to them should be removed. The eels are dropped alive into a salt-brine, where they die at once. They are opened from the head to the vent, washed in seawater, and finally drawn through the hands or through a roll of bast, which retains the slime. Finally they are salted down in barrels. A somewhat larger quantity of salt is used than in salting other fish. If they are to be kept for any length of time, they should, after from eight to fourteen days, be relaid in one-eighth barrel of salt, and some new brine should be added.

Eel-fisheries are not carried on in Norway to any great extent. During the sprat-fisheries eels are often found in large masses outside the nets. Even if the fishermen did not eat them, or sold them fresh, they might secure some little additional income by salting them. When salted and properly treated, they are always sure to find a market.

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* "*Johan Knudsen Haraldseidraags Aaleteine.*" From *Norsk Fiskeritidende*, vol. iv, No. 2. Bergen, April, 1885, p. 154. Translated from the Danish by HERMAN JACOBSON.

95.—ON THE REARING, GROWTH, AND BREEDING OF SALMON IN FRESH WATER IN GREAT BRITAIN.

By FRANCIS DAY.

[Abstract of a paper before the Linnean Society of London, March 5, 1885.]

In December, 1880, Sir James Maitland, at Howieton, obtained salmon eggs and milt from fish captured in the Teith, and from which ova hatched in March, 1881. In July, 1883, it was seen that some of the young salmon, then two years and four months old, were in parr livery or had assumed the dress of the silvery smolts, the latter in certain lights showing parr bands. On November 7, 1884, a smolt 1¼ pounds weight jumped out of the pond and from this fish about 100 eggs were taken. As they seemed to be ripe they were milted from a Loch Leven trout. On January 23, 1885, 18 of these eggs hatched, and the young were strong and healthy. On November 11, 1884, about 12,000 Loch Leven trout eggs were milted from one of the foregoing smolts and they hatched on January 28, 1885. On December 1, 1884, 1,500 eggs were taken from two of the foregoing smolts, and milted from one of the males. On the 9th about 4,000 eggs from these smolts were fertilized from one of the males, and on the 13th 2,500 smolt eggs were milted from a parr. Pure salmon eggs have been hatched in the Howieton fishery; the young have grown to parr, smolts, and grilse; these latter have yielded eggs, and their eggs have been hatched with a fair degree of success.

Although some time must elapse before it can be ascertained how these young salmon will thrive, how large they will eventually become in freshwater ponds, and whether a landlocked race may be expected from them, still the following points seem to have been established: That male parrs or smolts may afford milt capable of fertilizing ova, but if taken from fish in their second season, at thirty-two months of age, they are insufficient to produce vigorous fry; that female smolts or grilse may yield eggs at thirty-two months of age, but those a year older are better adapted for the production of vigorous fry; wherefore to develop ova a visit to the sea is not a physiological necessity; that young male salmon are more matured for breeding purposes than are young females of the same season's growth; that female *Salmonidæ* under twenty-four months of age, although they may yield ova, are of little use for breeding purposes, the young, if produced, being generally weak or malformed; that at Howieton hybrids between trout and salmon have so far proved to be sterile. Furthermore, it was stated that the size of eggs of the *Salmonidæ* vary with the age and condition of the parent; but, as a rule, older fish yield larger ova than the younger ones. Even among the eggs of individual fish variations occur

in the size of the ova. From larger ova finer and rapidly growing fry are produced; consequently, by a judicious selection of breeding fish, races may be improved, while it is only where segregation is efficiently carried out that such selection is possible.

96.—EFFECT OF SUNLIGHT UPON SHAD EGGS.

By W. F. PAGE.

In May, 1881, at Gunston, Va., on the Fish Commission barges, I observed for the first time the peculiar and astonishing effect of direct sunlight falling on shad eggs. Having occasion to make an unusually large deposit of embryo shad in the channel of the river at a time when our buckets and cans were in use, I used a large shallow tin pan in which to transport the "leavings" of the cones. Previous to taking the row-boat out to the channel, I placed the pan on the outer deck of the barge and went back to some work in the hatchery. Returning in a few minutes, I was surprised to see the pan alive with fish, and it occurred to me that this might be brought about by the direct sunlight falling upon the eggs. Since that time I have had abundant opportunity to test this phenomenon, and have adduced the following facts: (1) That the time of hatching any particular lot of shad eggs can be shortened from twelve to fifteen hours by judiciously exposing them to direct sunlight in shallow, highly-polished pans; and (2) that the fish so procured are fully equal in vitality to those allowed their full time in the eggs. During the spring of 1884, I made a practice at Central Station, when a car shipment was wanted by a given time, of placing the youngest eggs where the greatest amount of direct sunlight would fall on the hatching jars, at the same time giving the older eggs less light as development was more advanced. This was done with a view to hastening the younger eggs and retarding the older, so that the fish for the entire shipment might all hatch about the same time. By this means I have, on several occasions, been enabled to hatch out at the same time different lots of eggs having a variation in their ages of as much as thirty hours. In my reports of the work at Central Station for the seasons of 1883 and 1884 it will be observed that there are considerable variations in the time of the incubation of eggs of the same age; which is to be explained by the difference in the amount of light the hatching jars received. I have not been able to observe with the thermometers at my command any increase of temperature in the water employed in the work with the pans, and the pans painted black are entirely useless for the purpose. Though many fish-culturists deprecate the effect of direct sunlight on fish eggs as having a weakening effect on the embryo, experience has demonstrated that the fish assisted in this way are as strong and travel as well as those allowed their full time in the egg.

WASHINGTON, D. C., *July* 1, 1884.

97.—CONDITION OF THE UNITED STATES TROUT PONDS.

By LOREN W. GREEN.

[Letter to Prof. S. F. Baird.]

Our weather still continues very hot and dry. California has never known just such a winter before. We have had no rain since the fore part of winter, and consequently our traps have been useless. I thought there would surely be 100,000 more eggs to ship, but I fear there will not. The trout in the ponds are nearly all done spawning, and the weather is so hot that it is almost impossible to handle them without great loss. The temperature to-day is 96° in the shade. Years before we have always taken eggs until the last of April, and should we have rains we may get the late run yet, but the creeks and river are very low. The water has been warm in the river and the trout have mostly spawned in the river instead of using the small creeks, as they usually do, but our trout are looking nicely. I received an answer from Mr. Gordon Land, Denver, Colorado, saying the 10,000 eggs arrived in good condition. I received the telegram this morning ordering eggs shipped to different points. I have one lot more now on hand, which will be ready for shipment soon, of about 10,000. At present the temperature of the air is 96° in the shade; temperature of water, 56°.

BAIRD, SHASTA COUNTY, CAL., *March* 15, 1885.

98.—LOCATION OF A SALMON HATCHERY IN OREGON.

By C. H. WALKER.

As to the plan for renewing operations at the Clackamas River salmon hatchery, it has been said that it did not seem to be at the right point to be of any benefit to the Upper Columbia. I wish to call the attention of those who are interested in the matter of propagating salmon to what seems to me one of the best streams east of the Catskill Mountains, namely, the Des Chutes River, especially in the vicinity of the Warm Springs Agency. This river runs within a few miles of the agency, and for some distance above and below where the Agency River empties into it there are numerous coarse gravel or cobble-stone bars, where the salmon deposit their spawn, so the Indians say; and as salmon can often be seen on these bars during August and September, I have no doubt the Indians are correct. Des Chutes is the largest stream that enters the Columbia below the mouth of the Snake River and east of the Cascades. The temperature of the water is quite uniform the year round, always cool enough to be good drinking-water during the hottest days of summer and never cold enough in winter to freeze. Dur-

ing a period of eight years I have never seen a particle of ice floating down the stream, or forming, save on its banks, and then only after there had been a rise in the river and then freezing weather, which formed ice as the river fell. During these eight years I have known the river but once to rise as high as 7 feet above low water. Some winters it does not rise 2 feet, and for a majority of the eight winters it did not rise over 3 feet. All these points seem to me to make it a very desirable stream for the propagation of salmon. As the river enters the Columbia above all the principal salmon-fisheries, it would be an equal benefit to all.

WARM SPRINGS, CROOK COUNTY, OREGON, *July* 27, 1885.

99.—THE MOUNTAIN OR SALMON TROUT OF OREGON.

By Prof. DAVID S. JORDAN.

The trout from Portland* is the common Rocky Mountain trout or Clarke's trout, or Red-throated trout—*Salmo purpuratus* Pallas.

In Washington Territory it is known as mountain trout when taken in the rivers and brooks, and as salmon trout when taken in the sea or river mouths. Sea-run specimens are more silvery, with finer spots and less red than those taken in the small streams, and larger individuals are sometimes taken in the sea than are often seen in the rivers.

There is not the slightest doubt that the so-called salmon trout of the fish-dealers and the mountain trout of the sportsmen are one and the same fish, the only differences being temporary, dependent on the water and possibly on the food. I have myself caught hundreds of these same trout with the seine about Tacoma, in the sea, the locality from which this specimen was obtained. This species may always be known when fresh by a deep scarlet or crimson blotch on the membranes of the lower side of the lower jaw. This fish is, therefore, both a mountain trout and a salmon trout, as the names are understood in Washington Territory and Oregon. If the laws permit the killing of one and prohibit the killing of the other, the only test is whether caught in fresh or salt water.

INDIANA UNIVERSITY,
Bloomington, Ind., February 17, 1885.

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*Mr. J. C. Meudenhall, dealer in Columbia River salmon, at Portland, Oreg., forwarded a specimen, January 30, 1885, for identification, and wrote as follows: "To-day the Multnomah Rod and Gun Club of this city will send you a salmon trout for classification. This fish was taken from a net containing flounders, porgies, and smelt, off Tacoma Harbor, in Puget Sound, and it is called by all fishermen a salmon trout. They are caught in the waters of the Puget Sound and in the Columbia and in the tributaries near their mouths, but never near their sources or above falls or rapids. In this case the club claims it to be a mountain trout or a brook trout."

100.—WATER-BEETLES DESTROYING CARP.

By Prof. C. V. RILEY.

The large water insect which, according to the account of Mr. G. W. Peters, Caldwell, Sumner County, Kansas,* attacks and kills young carp is evidently some species of *Cybister* or *Dytiscus* of the coleopterous family *Dytiscidæ*. These carnivorous water-beetles occasionally abound in certain localities and are then a serious drawback to successful fish-culture. Moreover, since the German carp is a sluggish fish, it is much more exposed to the attacks of these beetles than most other kinds of fish. Unfortunately there is no way of poisoning the beetles and their still more voracious larvæ without at the same time destroying the fish, and all that can be done is to catch the beetles by means of a net shaped like a common butterfly-net and attached to the end of a bamboo pole. With a little practice many beetles may thus be captured within a short time, and by continuing this effort throughout the year the pest may be kept in check.

WASHINGTON, D. C., *March* 31, 1885.

101.—EDIBLE SHELL-FISH FOUND NEAR CUBA.

By ROBT. E. C. STEARNS.

[In reply to a letter of Mr. P. Benjamin, of Fulton Market, New York City, December 27, 1884.]

I have made inquiry and have learned only this, "That oysters of fair quality are rather abundant in the waters about Santiago, Cuba." The animal or soft portion of many of the conch shells, so-called, is eaten at various places by the negroes and others both in Florida and elsewhere in the Antillean-Caribbean region; but such gasteropod forms, while locally of some business importance, can hardly be so regarded in a broad commercial sense. Of the acephalans, or bivalves, the tellins and cockles of the cooler waters, at various places in the North Pacific and North Atlantic, are not only edible but often excellent in quality. There are species belonging to these groups within the region named, and of good merchantable size, but I am unable to specify any locality where they exist in such numbers as to afford a reasonable basis

*Mr. Peters wrote: "I received last fall 20 carp in good condition, and they have wintered well. Now as spring has come there is a big bug, shaped like a turtle, that is catching and killing my carp. There will seven or eight of these bugs attack a carp at once and stick to him till they eat him up alive. They can fly. They have two legs that they use to swim as a boy uses his arms. They are always in motion. Now I want to know how to get rid of them."

for a business enterprise. A common and widely distributed West Indian tellin (*Tellina radiata*), a very handsome shell-fish, is eaten regularly (that is to say, it is a staple article of food) at Manatee, Fla., and is called by the people there the "sun clam;" and, as before stated, there are several species of cockles of edible value, some of large size, the quality of which I know nothing about. Sometimes these are eaten by the people who live along the Florida coast.

UNITED STATES NATIONAL MUSEUM,
Washington, March 25, 1885.

102.—NOTES ON FISH-CULTURE IN IOWA.

By A. A. MOSHER.

WHITEFISH.—The whitefish eggs (1,000,000) sent from Northville arrived February 11, 1885, in splendid condition, and were all hatched by the 15th of April. I lost none except such as were unavoidably injured—not more than 50. They were put into Spirit Lake. This lake is about 4 miles square with a depth of about 22 feet, somewhat deeper in places. The shores are sand and gravel, with occasionally bowlders. The bottom is soft, out in the lake, say, from 20 to 40 rods; it seems to be a deposit of silt or fine mud, and seems to be full of animal life. If it is cold enough, I think they will do well. They were very lively and strong. We ought to hear from them, and no doubt would if we could catch them.

LOCH LEVEN TROUT.—The Loch Leven trout from the hatchery at Anamosa, in this State (about 30,000) were brought here by Mr. Aldrich, April 3, in good condition, and were put into West Okoboji Lake, being the only suitable lake in the State. This lake is in Dickinson County and is of the chain of lakes of which Spirit Lake is one. The water in Okoboji is very clear, never turbid, and very deep in some places—170 feet; has deep bays with gravelly shores mainly, and is about 6 miles long and from one-half to 2 miles wide. They were put in at the head.

WALL-EYED PIKE.—As to the wall-eyed pike, I have some eggs to send, but they are very glutinous. I have no trouble in impregnating them and have hurdles on which I put the eggs. I am anxious to send some eggs, but after repeated manipulations they will still adhere in bunches. Glass jars will not do. I have found that out, but by scattering them (after impregnating) on willow hurdles, I think they will be all right. In some of the eggs the embryo was very distinct, two-thirds developed forty-eight hours after impregnating. The pike are the common white-bellied ones, weighing from 2½ to 6 or 8 pounds, and are among the best fish, if not the best (excepting, of course, whitefish and trout), there are in this country. I have some pickerel (*Esox lucius*) eggs in good shape and doing well. They are not glutinous.

SPIRIT LAKE, IOWA, *April* 22, 1885.

103.—EFFECT OF WASTE PRODUCTS FROM PAGE'S AMMONIACAL WORKS UPON YOUNG SHAD FRY.

By MARSHALL McDONALD.

[Report to Prof. S. F. Baird for the District Commissioners.]

I respectfully transmit herewith a report of a series of experiments made in obedience to your instructions, with the object of determining the extent of the injurious or deleterious influences exerted upon young fish confined in water containing different proportions of the waste products from the ammonia works in West Washington.

The sample experimented with was furnished by the Board of Health, through Dr. J. H. Kidder, and was obtained from the Page ammonia works in Georgetown. A portion of the original solution has been retained for reference. The experiments were conducted by W. F. Page, superintendent of propagation at the Central Station, and the result shows that this waste product exerts a distinctly deleterious influence when present in water to the amount of one-fourth of 1 per cent. or in the proportion of 1 gallon to 400 gallons of Potomac River water. No experiments were made with solutions of less strength than one-fourth of 1 per cent. If we consider only the direct effect on young shad which have not yet begun to feed, it is probable that the area of injurious pollution in the case of the Potomac River does not extend very far from the point at which the waste products are discharged into the river.

Before coming to any definite conclusion, however, we must take into consideration the fact that very young shad, which have not yet begun feeding, are much less sensitive to injurious influences in the water in which they are than the same fish after their sacs have been absorbed and they have begun feeding. We must further consider that the minute food upon which the young shad feed is much more sensitive to injurious influences (especially those exerted by the presence of coal-tar products) than are the young fish which feed upon them.

RECORD OF EXPERIMENTS.

1.—One hundred newly-hatched shad were put in 20 ounces of the refuse, 100 per cent strength, at 9.40 a. m., May 21, 1885. In 40 minutes they were all weak, at the bottom of the dish, and barely moving; 12 m., all dead.

2.—One hundred newly-hatched shad were put in 20 ounces of mixture, 75 per cent strength (3 parts refuse, 1 part Potomac water), at 9.40 a. m., May 21; 11 a. m., commenced to weaken and go to the bottom; 12.30 p. m., very few alive; 1.30 p. m., all dead.

3.—One hundred newly-hatched shad were put in 20 ounces of mixture, 50 per cent strength (10 ounces of refuse, 10 ounces of Potomac

water) at 9.40 a. m., May 21; 11 a. m., showed signs of weakness, part going to the bottom; 12.30 p. m., few swimming, but majority were at the bottom and quiet; 1.30 p. m., all were at bottom, many dead; 2.15 p. m., all dead.

4.—One hundred newly hatched shad were put in 20 ounces of mixture, 25 per cent strength (5 ounces of refuse and 15 ounces of Potomac water) at 9.40 a. m., May 21, 11 a. m., all up and swimming, but a little weak; 12.30 p. m., about one-half on bottom, others weak and spasmodic in their movements; 1.30 p. m., half dead, others dying; 4 p. m., all dead.

5.—One hundred newly-hatched shad were put in 20 ounces of mixture, 10 per cent strength (2 ounces of refuse and 18 ounces of Potomac water) at 9.40 a. m., May 21; 12.30 p. m., but few were affected, majority up and swimming but showing slight signs of weakness; 6.30 p. m., 50 per cent dead; 8 p. m., 75 per cent dead; 7 a. m., 22d, 90 per cent dead; 4 a. m., 23d, all dead.

6.—One hundred newly-hatched shad were put in 20 ounces of Potomac water at 9.40 a. m., May 21. All were still alive when all were dead in the previous experiments. After the 27th of May, they began to die, and by the 30th none were alive.

7.—One hundred newly-hatched shad were put in 20 ounces of mixture, 5 per cent strength (1 ounce of refuse and 19 ounces of water) at 2 p. m., June 2; 6 p. m., 12 fish dead; 6 a. m., June 3, 30 fish dead, others weak; 6 a. m., June 4, 40 fish dead, others weaker; 6 a. m., June 5, 52 fish dead, remainder very weak and at the bottom; 6 a. m., June 6, all dead.

8.—One hundred newly-hatched shad were put in 20 ounces of mixture, 1 per cent strength (1 part of refuse and 99 parts of water) at 2 p. m., June 2; 6 p. m., 9 fish dead; 6 a. m., June 3, 16 fish dead, remainder all right; 6 a. m., June 4, 25 fish dead, remainder weak; 6 a. m., June 5, 31 fish dead; 6 p. m., 55 fish dead; 6 a. m., June 6, 73 fish dead; noon, June 6, all dead.

9.—One hundred newly-hatched shad were put in 20 ounces of mixture, .5 per cent strength ($\frac{1}{2}$ part refuse and 99$\frac{1}{2}$ parts water), at 2 p. m., June 2; 6 p. m., all alive and strong; 6 a. m., June 3, three dead, remainder all right; 6 a. m., June 4, three dead, remainder well; 6 a. m., June 5, fourteen dead, remainder fair; 6 a. m., June 6, wenty-seven dead, remainder much weaker and suffering; 6 p. m., June 6, all dead.

10.—One hundred newly-hatched shad were put in 20 ounces of mixture, .25 per cent strength (.25 part of refuse and 99.75 parts water), at 2 p. m., June 2; 6 p. m., all well; 6 a. m., June 3, four fish dead, others better than in No. 9; 6 a. m., June 4, four fish dead; 6 a. m., June 5, sixteen fish dead; 6 a. m., June 6, twenty-three fish dead; 6 p. m., fifty-seven fish dead; 6 a. m., June 7, all dead.

11.—One hundred newly-hatched shad were put in 20 ounces of Potomac water at 2 p. m., June 2. But few are alive now (noon, June 8), and these have but little vitality.

104.—ARTIFICIAL PROPAGATION OF ROCKFISH AND EELS.

By E. R. NORNY.

Most of the breeding rockfish that are caught in seines are caught here at my place, and the season for them is nearly over. We do not get as many as we did some ten years ago, but I think they are more numerous than they were a few years since. This is to be accounted for by there not being so many sturgeon nets fished on the spawning grounds as formerly. The rock are not mature when we get them; hence our failure with them some nine years back. The only way to succeed is by putting the fish in a pond until mature, and then hatch the eggs. I have a pond of half an acre within 60 feet of where the seine is hauled. I placed a 60 pound fish in this pond on the 1st of May, a few years ago, and by the 11th of May it had passed the spawning time, thus showing that when they make their appearance here they are within from ten to fourteen days of spawning. We begin to get them uniformly about the 12th of April, and they leave about the 1st of May; they are not numerous, but a very few would make some millions of young. The water could be let out of this pond in summer, and it could be made of a uniform depth, and a trunk to lead from it to the bay, to furnish fresh water every tide; I do not think the expense would exceed $300. I would put all the breeding fish we get in this pond, and then if you would send your steamer here about the 1st of May and strip the fish as they mature, you could make a success of hatching these fish. The water is brackish in summer; we use it for an ice pond only; if it had a trunk to it to furnish fresh water, I should this season put in both male and female, and leave them there to see if they would breed naturally. If you would like to make this experiment the work should be done in August, as there are rarely any tides at that time of the year to interfere with the work.

EELS.—I think I have solved the eel problem. Our fishermen opened two just after they came out of the mud a few weeks since, and they both had clear and distinct roe in them in two lobes; the eggs were very small. At the same time, the flats here at low water, just at the water's edge, when the sun shone warm, showed myriads of young eels, not larger than a cambric needle. It is clear that they hibernate in the winter to breed, the roe forms and matures during this period, and the young are hatched just at the end of this period. Hence no roe is found in them during the summer and fall. Their migration in summer to head-waters is for food; their return in fall to salt water is for breeding purposes.

ODESSA, DEL., *May* 1, 1885.

105.—KLIP-FISH AT THE SHETLAND ISLANDS.*

By Abr. ANNANIASSEN.

Cod, ling, and bream fisheries are carried on all round this group of islands; the ling and bream fisheries, however, principally on the east coast from Sumburgh Head to Haroldswick, at a distance of from 10 to 50 miles from the coast. The cod fisheries are mainly found on the west coast, principally in March, for which reason the inhabitants of these islands generally call them the "winter fisheries,"† while the ling and bream fisheries are carried on during April, May, and June, until the herring fisheries begin. The most important fishing stations on the east coast are: Lerwick, Whalsay, and Skerries; and on the west coast: Fethaland, Stenness, Papa-Stour, Vaila Sound, and Scalloway. Natives of the islands are engaged principally in these fisheries.‡ Sometimes deck-boats are employed, but more frequently open boats, having one mast and a lug-sail, and generally a crew of from 4 to 6 men. They are good sea-going boats. The deck-boats likewise have one mast, and are rigged like a sloop, and their crew generally numbers from 5 to 7 men. As a general rule lines with hooks are used, the hooks, however, being somewhat larger than those used in Norway. The distance between the hooks is 3 or 3½ fathoms. A cork buoy is used, through which passes a pole from 9 to 12 feet long. The cork buoy is in the middle of the pole, which has a sinker at the lower end to keep it in a perpendicular position. As the lines are always hauled in while the boat is under full sail, six to ten extended and painted ox-bladders are fastened to the cork buoy at intervals of one foot. When the line is to be hauled in the bladders are drawn in with the boat-hook. The lines are placed in baskets which on the inside have an upper edge of fine cork in which the hooks are fastened. Each basket holds generally 150 hooks, or from 450 to 500 fathoms of line. As a general rule from 16 to 20 baskets are used, so that the entire length of the lines is nearly 10 geographical miles. Each line-fisher, moreover, carries from 16 to 20 nets, which are cast every evening to obtain the necessary bait. If the weather is favorable for net-fishing, a sufficient quantity of bait is always procured. If one of the boats happens to be less successful, one of the more fortunate boats renders assistance, without any pay, which is a very general custom among the fishermen of these islands. The nets are generally hauled in about midnight, and immediately

* "*Fiskeriet og Tilvirkning af Klipfisk paa Shetlandsöerne.*" From *Norsk Fiskeritidende*, vol. iv, Bergen, April, 1885. Translated from the Danish by HERMAN JACOBSON.

† Of the fish caught in winter 800 to 1,000 generally yield one barrel of liver, while of the fish caught during summer 1,000 to 1,200 are needed to make up that quantity.

‡ In 1882 the number of fishermen was 2,981, and the number of boats 629.

afterwards the lines are set. This is always done while the boat is under way, and the hooks are baited as the lines are being set, by 2 or 3 men who stand round the basket and put the bait on the hooks. As the hooks are arranged in order along the cork-band round the upper edge of the basket, each man takes one in his turn, so that the baiting is done easily, even if the boat is in rapid motion. An entire small herring is attached to each hook by passing the barb through the vent.

At the beginning of the fisheries each fisherman makes a contract with the dealer whom he furnishes with fish. If a boat stays out more than three days a reduction is made in the price, according to the appearance of the fish and the time the boat was out.

The board furnished the fishermen is generally good, consisting principally of wheat bread, cheese, butter, and nearly every day pudding, besides various canned goods. Tea and coffee are the usual drinks, liquor being used but very rarely. When in port the men live on shore, generally with the merchant who buys the fish.

As the fisheries are almost exclusively carried on with lines, the fish are rarely killed, as they are generally dead before they reach the boat. All fish, however, which are taken with hand-lines are killed, either by a cut across the throat or by driving the knife into the heart.

The fishermen of the Shetland Islands clean the fish in the same manner as the Färöe and Iceland fishermen, so that the backbone remains in the left side, while in Norway it is usually left in the right side. It is cut through 1 or 2 vertebræ, from 18 to 24 vertebræ from the tail, according to the size of the fish. The knife used generally has a length of about 31½ centimeters and a breadth of 5½ centimeters. The blade has an upward curve, and the point is semicircular. Those made by blacksmiths on the spot are preferred to machine-made knives. According to my opinion the Shetland fishermen cut too deep, often down to the skin, which weakens the consistency of the fish; and several of the fishermen agree with me on this point.

As soon as the fish has been cleaned it is washed. The washing is done in boxes. The side at which the washer stands is somewhat slanting, while the other, alongside of the cleaning bench, is straight. The fish are pushed into the box from the bench. The water is pumped out of the sea and is led into the boxes through troughs. Most of the boxes have over the bottom a grating, under which that portion of the dirt which sinks to the bottom can gather, whereby the water is kept clean for a considerable time. When the water is to be changed, the dirty water is allowed to flow off through a hole in the bottom. The washing of the fish is generally done by women, and brushes are used. There is generally one washer to each cleaner. All impurities are carefully removed, especially all blood, while at present people are not very particular about the thin black skin. After the fish have been washed they are placed in boxes made of laths placed at intervals of 2.2 centimeters, so that the water can flow off.

The salting is generally done in tubs, and but very rarely in boxes. As a general rule Liverpool salt is used, but occasionally one-third Lisbon or Setubal salt is mixed with it. One counts 1 barrel of salt to 4.5 barrels of raw or 2 barrels of cured fish. No difference is made in this respect between fresh fish and fish which have lain some time. Experiments relative to the weight of the fish showed the following results:

Twelve hundred pounds of raw fish, when taken out of the salt-brine, weighed 800 pounds; therefore the loss of weight in the salt was 33.3 per cent. After having been dried for seven weeks the same quantity of fish weighed 533 pounds, making the loss through drying 22.3 per cent. The total loss was, therefore, 55.6 per cent, which corresponds to the proportion given above, namely, 2 barrels dried from 4.5 barrels raw fish. After the fish have lain in salt from four to seven days they are taken out. If there is no opportunity to begin the drying process, the fish are piled up in heaps, with a little salt between each layer. There is no absolute rule as to how much salt is to be used; generally, however, one-fourth barrel of salt is counted to 1 barrel of salted fish. The fish remain in these piles until the drying process can begin, and the winter fish generally remain until the first part of April.

The washing which precedes the drying is done in boxes with saltpeter, like those described before, with the only exception that both sides are slanting. During the washing the necks are cleaned with special care, and the thin black skin is completely removed. Brushes with a handle are used. After the fish have been washed they are laid in small heaps, all turned the same way, and if possible in places where the ground slopes a little. If the weather the next day is dry, the fish are exposed to the air; if not, they are covered with mats; but the heaps are not rearranged. When the fish have had one good drying-day, they are arranged in square heaps, each containing at most one-half ton (500 kilograms); thus they remain two or even three days, when they are again spread out. After they have had two or three good drying-days they are arranged in larger heaps, each containing 3 or 4 tons, when the pressing begins, the fish remaining in these heaps two or three days between each spreading. As the drying progresses, the heaps are made larger, containing 5 or 6 tons, and the fish are spread out only every third or fourth day. When the fish are arranged in these heaps, care is taken that those which were at the bottom when spread out are put on the top. The heaps are always well covered with mats. In no case are stones placed on the top of the heap. The time occupied in drying is generally from five to seven weeks, sometimes more. As a general rule the fish are dried on natural banks of stones or pebbles. In some places a scaffolding is used, consisting of props two feet high across which laths are laid (three to the foot). Such scaffoldings are preferred to stone banks. During the drying season the sun is seldom warm enough to hurt the fish. Sometimes, however, this will happen; and in that case the fish are, as with us in Norway, placed on edge, always

two and two together. The fish in that case are also washed in strong brine, the heaps are frequently changed, and the fish are pressed.

The principal difference between the Shetland and the Norwegian method of drying is this: That in the Shetland Islands the fish are not pressed so much. The fish which are called well dried, are, however, according to my idea, moist and contain too much salt. Those fish are called first-class which, when held against the light or the sun, shine, and which on the flesh side have a fine white crust of salt. In Norway such fish would be considered salted too much. The Shetland fishermen do not use more salt than we do; but, as the fish are pressed less, more salt remains in them in proportion to the water and the solid parts than is the case in our method of drying. With us some of the water is pressed out, and thereby also a corresponding quantity of salt, and the superfluous water is removed more by evaporation, while in the Shetland Islands the drying is done by having a current of air strike the fish on both sides.

While the fish are lying in heaps waiting to be shipped they are covered with mats and sails. The packing-sheds are constructed partly of stone and partly of wood. If they are frame, the sides, both inside and outside, are covered with boards.

Besides cod, ling, and bream, coal-fish are also cured as klip-fish. The refuse is packed in barrels, and either sent to Scotland or to the various guano factories on the Shetland Islands.

The principal markets for the Shetland fish are Spain, Ireland, and Scotland. Well-dried fish also find a market in London. A considerable amount of well-dried fish, not too strongly salted, is put up in tin cans, packed in wooden boxes, and shipped to Australia.

106.—POUND AND NET FISHING AT ERIE, PA.

By M. E. DUNLAP.

Two methods of fishing are practiced at this place. About 200 miles of gill-nets are fished from this port. Eight pound-nets have been fished about 10 miles west of the entrance to our harbor. Over 100 tons of dead fish from the gill-nets have been thrown away annually, most of them back into the lake where they were caught, thus fouling the whitefish grounds. The gill-nets are fished all the year when the ice does not prevent. The pound-nets are set only three months in the year, and all of the fish taken in them are alive and fresh and without spawn, and all of them of full marketable size, none of them having to be thrown away on account of size or because of their being stale. Which of the two methods is best: (1) for the protection of the fish and the continuance of the supply; (2) for furnishing good, sound fish

to the consumer; (3) which is the most destructive; (4) which is most calculated to exhaust the supply?

There are only about 2 miles of frontage here where pound-nets can be set, on account of the form of the lake bottom. Just along here for the 2 miles it is a sand and mud bottom, and the only place where pound stakes can be driven. The rest of the shore from here to Silver Creek, in New York, and from here to Fairport, in Ohio, is rocky bottom, and pound-nets cannot be set. Thus we have a rocky shore for a distance of almost 200 miles, with only a small space of sand and mud at this place.

ERIE, PA., *March* 27, 1885.

107.—RESTOCKING THE MERRIMAC RIVER WITH LAMPREY EELS.

By GEORGE W. RIDDLE.

[Letter to Prof. S. F. Baird.]

Amoskeag Falls on the Merrimac River was once the great fishing-place of New Hampshire. It was here Passacanaway and his tribe of Indians lived and had their noted fishing-place, more than one hundred and twenty-five years ago; the waters teemed with salmon, shad, and lamprey eels. About forty years ago a high dam was built on the Merrimac River at Lawrence, Mass., 40 miles below here and some 25 miles from the mouth of the Merrimac River, which enters the Atlantic Ocean at Newburyport, Mass.

Since the building of the Lawrence dam (30 feet in height) fish and eels have become extinct, as they could not reach the spawning beds. Fishways have been built ten years or more, but no eels and but few salmon have come up the river. Four years ago I took from the Lawrence fishway some 200 lampreys, placed them in barrels, and transported them by rail above Amoskeag Falls. The result is that this year thousands of full-grown eels have put in an appearance and have gone up through the fishway.

They have ascended the river to the hatching house at Plymouth, 150 miles from the mouth of the river. Thousands of them have been seen at Amoskeag Falls in this city on their way to the spawning bed. As they have once more reached their spawning beds, I have no doubt that the return is a permanent one.

It is a great satisfaction to the fish commissioners to know that they have succeeded in restocking this river (which turns more machinery than any other river in the world, it is said) with lamprey eels, and it gives our people much encouragement to go on in the great work of restocking the large water-area of this state.

MANCHESTER, N. H., *June* 19, 1885.

Vol. V, No. 21. Washington, D. C. Aug. 21, 1885.

108.—NATURAL AS COMPARED WITH ARTIFICIAL HATCHING OF WHITEFISH.

By FRANK N. CLARK.

[In reply to a letter of Mr. R. Bell to Prof. S. F. Baird.*]

The swarms of young fish referred to are not whitefish. They are a species of small "shiner" or "chub" which congregate around docks, wharves, and shoals in countless numbers at nearly all seasons of the year in all of the great lakes. I have seen them so thick that a single thrust of a dip-net would bring in several hundred. I have found a few herring among them, but never any whitefish. The offal and refuse from fisheries undoubtedly attracts large numbers to such places.

The claim that whitefish and herring hatch in six days or less is highly erroneous. It requires two and a half to six months, according to temperature of water; and the time of incubation is neither hastened nor retarded by "artificial" processes or treatment, provided water of the same temperature is used. The claim that millions of fish are hatched from the spawn discharged from the fishery is equally erroneous. Mr. Bell can make some interesting tests and experiments on these questions with very little trouble and expense. I would suggest that boxes or tanks with wire bottoms and sides be provided, and placed under the fish-house, or anywhere else in the lake. Put into one of them a quantity of spawn as discharged from the fishery, and into the other a supply of eggs known to be fertilized; then leave them undisturbed and note the outcome. The fertilized eggs may hatch a few fish the following spring, although the chances are that fungoid and confervaceous growths will destroy every egg; the other box will hatch nothing. Now, place some fertilized eggs in another box and give them the same care they would receive in a hatchery; that is, remove all dead eggs as fast as they appear and keep them free from dirt and sediment. The result will be, if the eggs were ripe when taken and properly fer-

* Under date of Port Clinton, Ohio, March 31, 1885, Mr. R. Bell, of the firm of R. Bell & Co., dealers in fresh, salt, and frozen fish, wrote in substance as follows: "I think there are millions of herring and whitefish hatched every fall under our fish-house, and that they hatch in less than six days after the eggs go into the water. No young fish are to be seen here until about ten days before they commence spawning, when the water becomes perfectly alive with young fish, resembling whitefish and herring. I cannot think it possible for the eggs to lie in the lake three months before hatching. I think artificial hatching of fish of all kinds is a good thing in order to transfer them from one place to another, but to take the eggs from any water and put the fish back in the same water seems time and money lost. To transport the eggs will increase the fish a thousand times faster and with a cost of less than 1 per cent of what hatching and transferring the young fish costs."

tilized, a hatch of 70 or 80 per cent. This will show the value of artificial treatment.

The reasons why spawn as discharged from the fishery will produce no fish, are at once apparent when we consider the conditions that are absolutely essential for reproduction. The eggs must first be fertilized, and to accomplish this they must be mature and come in contact with milt which is unimpaired in vitality; and then, to carry them through the long period of incubation, the dead eggs must be removed; otherwise the confervaceous or "mossy" growth therefrom will spread and destroy them all. Now, the chances of these essential conditions being fulfilled in the case of spawn dumped from the offal barrel, or dropped through the floor of the fishery into the water below, are too small for computation. First, from 75 to 100 per cent of the eggs dressed from the fish are "unripe"—that is, the egg germ is immature and incapable of being fertilized; second, both males and females are generally dead before the dressing is commenced; and fertilization is out of the question when all vitality has departed from the male principle; and, third, granting that 25 per cent of the offal spawn is fertilized, which is highly improbable, there would still remain 75 per cent of dead eggs—sufficient to make a rotten mass of the whole batch in a comparatively short time.

Artificial propagation consists simply in bringing the germ and vitalizing principle together at the proper time, and then protecting the embryo; and the assistance thus rendered enables us to produce results many times greater than nature can produce.

NORTHVILLE, MICH., *April* 15, 1885.

MEMORANDUM BY PROFESSOR BAIRD.

The conditions under which the whitefish develop have been thoroughly established, both in this country and in Europe. Such acceleration of development as that referred to is entirely contrary to the nature of the fish. The small fish mentioned are probably of quite a number of species, principally the young of minnows and chubs, mixed with a few species that never attain a length of more than a few inches. The drippings from the fish-houses and the discharge of offal into the water in their vicinity would undoubtedly tend in a short time to bring together an immense congregation, a phenomenon which I have myself witnessed many times.

I shall be glad, however, to put this question to a careful test by an examination of any specimens that may be collected and sent to me. An ounce of fact is worth a pound of speculation, and whatever may be the probability the question can only be settled positively by observation and experiment. There is not the slightest difficulty in identifying a whitefish, even just from the egg, still less when several inches in length.

The egg of the sea salmon requires still longer to hatch out than that of the whitefish, and many cases are on record where an examination of natural spawning beds in the spring has shown the existence of eggs with embryos in them which had been deposited by the parent fish during the previous autumn.

WASHINGTON, D. C., *April* 18, 1885.

109.—REPORT ON THE SCHOODIC SALMON WORK OF 1884-'85.

By CHAS. G. ATKINS.

The measurement of the stock of Schoodic salmon eggs at Grand Lake Stream at time of packing and shipment, and the record of previous losses, enable me to complete the statistics, as follows:

Original number taken	1,820,810
The total losses up to that time, including the unfertilized, which were removed before packing	254,410
Net stock of sound eggs	1,566,400
Reserved for Grand Lake	397,400
Available for shipment to subscribers	1,169,000

These were divided among the parties supplying the funds for the work in proportion to their contributions, as follows:

Allotted to the United States Commission ($\frac{13}{25}$)	608,000
Allotted to the Maine Commission ($\frac{5}{25}$)	234,000
Allotted to the Massachusetts Commission ($\frac{4}{25}$)	187,000
Allotted to the New Hampshire Commission ($\frac{3}{25}$)	140,000
Total	1,169,000

The share of the United States Commission was assigned and shipped, under orders, as follows:

A. W. Aldrich, commissioner, Anamosa, Iowa	50,000
E. A. Brackett, commissioner, Winchester, Mass	25,000
H. H. Buck, Orland, Me., to be hatched for Eagle Lake, Mount Desert	20,000
Paris, Mich., for Michigan commission	50,000
Madison, Wis., for Wisconsin commission	50,000
R. O. Sweeny, commissioner, Saint Paul, Minn	50,000
South Bend, Nebr., for Nebraska commission	20,000
E. B. Hodge, commissioner, Plymouth, N. H	40,000
Cold Spring Harbor, N. Y., for New York commission	60,000
Plymouth, N. H., for Vermont commission	25,000
Plymouth, N. H., for Lake Memphremagog	25,000
Central Station, Washington, D. C	10,000
R. E. Earll, World's Exposition, New Orleans	5,000
G. W. Delawder, commissioner, Baltimore, Md	5,000
Myron Buttles, North Creek, N. Y	5,000
A. R. Fuller, Meacham Lake, N. Y	20,000

F. Mather for transmission to Europe as follows:		
For Herr von Behr, Germany	40,000	
For Tay Fishery Board, Scotland	20,000	
For National Fish Culture Association, England	30,000	
		90,000
Enfield, Me., for Maine commission		58,000
Total		608,000

A few of the shipments have been heard from, and these all reached their destinations safely.

BUCKSPORT, ME., *March* 31, 1885.

110.—INJURIES CAUSED BY GILL-NETS TO WHITEFISH.

By D. Y. HOWELL.

[From a letter to M. E. Dunlap, Erie, Pa.]

The gill-net is far more destructive to whitefish than any other apparatus, for the following reasons: 1. Gill-nets are fished during every month of the year when ice does not prevent, and the meshes having been reduced to such size that millions upon millions of small young whitefish, no larger than herring, are taken, and on account of their size are unmarketable. 2. A very large percentage of whitefish taken in gill-nets are not fit for food when taken out, for the reason that they are strangled and immediately begin to bloat, and in many instances are rotten or nearly so when brought to market; whereas when caught in pound-nets they are all alive and healthy, and while in the nets have had a chance to deposit their spawn (if ripe), thus saving at least a portion of spawn, which is utterly impossible while strangled and rotting in a gill-net. As pound-nets are only fished in comparatively shallow waters, few if any small whitefish are taken, as they inhabit the deep waters until mature, and not until then do they seek their spawning grounds or such localities where pound-nets are fished. We have fished for about thirty years, and have never discovered any falling off in the catch of whitefish, taking the average one year with another, until the last few years, or since the lower end of Lake Erie has been filled with gill-nets, covering nearly every rod of it, until the time when the fish start for their spawning grounds, when they are closely followed by the netters, and few are left to reach there, they not only destroying the adult fish but the greater portion of the small fry, which are yearly produced at great expense by the State hatcheries, few of which live long enough to reproduce; and there is no gill-net, however small, but destroys more fish ten times over than any pound-net, and not more than one-tenth of the fish so destroyed are fit for food, which is simply a criminal waste.

TOLEDO, OHIO, *March* 31, 1885.

111.—MONSTER SEA-SERPENTS.

By RICHARD A. PROCTOR.

[From Knowledge, April 3, 1885.]

I have always been a believer in the sea-serpent of Captain McQuhae, of the Dædalus. I was a very young lad when his report of the strange encounter first appeared; but it seemed to me then, and it seems to me still, that the sea-captain had much the best of the discussion with the representatives of science. There was that cautious naturalist and paleontologist, Richard Owen, so anxious to disprove the sea-serpent that he pictured to himself the captain and officers of a British frigate frightened out of their wits, and out of at least one of their senses, by the sight of a sea-elephant (as he tried to make it out) rather far away from its native abode, and urging its course as fast as possible homeward. Captain McQuhae, in a report to the Admiralty, says that he and his officers saw a long-necked sea-monster traveling swiftly in the teeth of a 10-knot breeze on the surface of the sea, so quickly that he could see the waves frothing against the creature's chest. It passed so near that he could have distinctly seen the features of a man at the distance. He and his officers had a good view of the creature. (For a wonder they were not possessed by the customary desire to shoot it, a desire which speaks as honorably of the human race as the saying of the North Country miner immortalized by Leech, who, seeing a stranger, thought it due welcome to "'eave 'arf a brick at un.") They rejected the sea-elephant with derision, as entirely inconsistent with what they had clearly seen; while the idea of their being frightened—well, Americans in old times tackled a few of our British frigates with greater or less success, but they did not find our seamen quite so timorous as to be likely to tremble in their shoes at the sight even of an extra large sea-elephant. Yet Professor Owen persisted in his belief that the Dædalus sea-serpent story was not worthier of credence than a story about ghosts. That particular ghost he thought he had laid.

Since then all sorts of explanations of sea-serpent stories have been advanced. Because one captain has mistaken a lot of floating sea-wrack half a mile away for a sea-monster, therefore the story of a sea-creature seen swiftly advancing against wind and sea, at a distance of less than 200 yards, meant nothing more than misunderstood sea-weed. Another mistakes a flight of birds in the distance, or a shoal of porpoises, or even a range of hills beyond the horizon, for some sea-serpentine monster, and forthwith other accounts, however manifestly inconsistent with such explanations, are regarded as explained away. Then, worst of all, some idiot invents a sea-serpent to beguile his time and find occupation for his shallow pate; and so soon as the story is shown to be only a story,

men of sense and standing, as incapable of the idiocy of inventing sea-monsters as I am of inventing a planet, are supposed to have amused their leisure by sending grave reports of non-existent sea-monsters to men under whom they (the seamen, not the sea-monsters) held office, or by taking oath before magistrates that they had seen sea-creatures which they had invented, and by parallel absurdities.

All this has been done in the case of the sea-serpent, as something akin to it was long since done in the case of the camelopard, and later in the case of the gorilla. Much earlier Herodotus had been called the Father of Lies instead of the Father of History, because of wonders related by him which have since been shown to be facts. The poor (in intellect and veracity) are always with us; and they can never admit that anything exists outside of what they know, or understand how any traveler in little-known regions can fail to lie lustily when he comes home again. Among the creatures thus specially ridiculed, the monster earthworm described by Rapp some forty years ago, was specially ridiculed, and those who believed in it, or declined utterly to reject it, were sneered at just as those who recognize the reasonableness of the sea-serpent are laughed at now. Rapp said he had seen in South Africa a monstrous earthworm, several feet in length. One of these he described as 6 feet 2 inches long, and proportionately thick. The measurement was regarded as no worthier of credence than Gulliver's precise statements of the height of Lilliputian and Brobdingnagian animals. The absurdity and impossibility of the thing was abundantly proved. A worm of the ordinary kind averages, let us say, 6 inches in length. Here, if this lying traveler was to be believed, was an animal more than twelve times as long, and therefore some 1,800 times as large. Now, the ordinary boa-constrictor is about 18 feet long. Multiply his length by twelve, and we get a serpent of 216 feet in length. *Credat Judæus*, &c. Rapp was demonstrably a vender of lies—so, at least, said the young buccaneers of the press. Well, there is now in the Zoological Gardens in London a living specimen of the species described by Rapp. It is not one of the largest. Indeed, these creatures are hard to catch and keep alive; and probably the biggest are the most difficult to secure. They are described as "fairly abundant in the neighborhood of Port Elizabeth and other parts of Cape Colony," but they keep out of sight unless heavy rains drive them out of their holes, when hundreds of them can be seen crawling about, but they usually perish soon after thus visiting the surface. The specimen at the Zoological Gardens is about 5 feet long, however, so that it is quite a good-sized worm. Here, then, is a case where a creature, the description of which excited as much ridicule as that of the sea-serpent, is found not only to exist in large numbers, but to be amenable to the customary treatment extended by our kindly race to the inferior races: we have captured a specimen and keep it on show.

Yet those who formerly laughed at the earthworm laugh now about

the fancied sea-serpent. They laugh so consumedly, and make so much noise over it—the laughter of such folks being "as the crackling of thorns under a pot"—that, as my friend Mr. W. Mattieu Williams points out, and as I can confirm, "much valuable evidence concerning the sea-serpent is suppressed by the flippant sneering of the class of writers who require no other qualification than ignorance of the subject on which they write. Scores, perhaps, hundreds of trustworthy mariners of all ranks, in both the naval and mercantile services, have seen what they believe to be such a creature, but they refuse to publish any account of their observations, knowing they will be insulted and publicly gibbeted as fools and liars if they do."

The foolish laughed in the same way over the kraken, as you point out, and the monster they rejected as impossible has been killed and measured. Whether the sea-serpent or any creature whose prey is chiefly sought at a considerable distance below the surface, will ever be captured or killed is very doubtful. But their existence ought never to have been regarded as doubtful after the evidence gathered in Massachusetts in 1817, and the report of the captain of the Dædalus. There are probably several varieties of sea-creatures which look like serpents, and among these varieties some may quite probably be really serpentine. But some of the supposed sea-serpents must have really propelled themselves otherwise than as serpentine sea-creatures do, for they moved rapidly along the surface without perceptible undulations, and nothing but concealed paddles could have urged them on in this way. In my article on "Strange Sea-Creatures," which appeared eleven years ago in The Gentleman's Magazine, several singular inhabitants of the sea—and in particular a monstrous skate seen in the East Indies—were described, and evidence given to show that even among comparatively familiar species new varieties are from time to time being discovered. Thus, though no sea-serpent so large as the sea orm or sea-worm, described by Bishop Pontoppidan as 600 feet in length, has as yet been seen, it does not follow that none such exists, albeit, I cannot doubt that the good bishop's accounts are very largely exaggerated. He was not quite so foolish as the modern critic, who, though perhaps he has never left his native town, undertakes to contradict men who describe what they have seen. But I fear he erred as far in the opposite direction. The boa-constrictor and the condor have been described in such terms by comparatively modern travelers (as Humboldt has shown) as would suggest creatures akin to the serpent which went for Sindbad, and the roc which also adorns Sindbad's narrative and appears elsewhere in tales of the East. But to exaggerate is one thing, to invent is another. The man who is foolish enough to lie about his traveling experiences is not capable of inventing a new animal worth five minutes' consideration; but, on the other hand, the man who, being sensible, is honest and truthful, is yet very apt to err in the way of unintentional exaggeration. I think poor

Captain Drevar's narrative of a long-necked sea-monster which captured in its folds and took down a sperm whale was a little exaggerated, though he and his mates swore to the truth of the story before a magistrate, and he himself was most unfairly punished by his employers for telling what he had seen: he was, in fact, ruined for life. ("I would not tell about it," said an old salt to Captain Drevar, "if I saw five hundred sea-sarpints.") But I no more believe that these men would have invented such an animal if they could, or could have invented it if they would, than I believe that an utterly ignorant man could have devised the famous lunar hoax—the clever story respecting a powerful telescope showing living creatures in the moon. Yet that story did not, as was alleged, take in Arago; no one acquainted with optical laws could have been deceived by it for an instant. To imagine that sailors could accomplish the far more difficult feat of inventing a new kind of animal without immediately exposing their ignorance to every one acquainted with the laws of comparative anatomy, is to imagine the impossible.

112.—PROPOSED REMOVAL OF FISH-TRAPS FROM COLUMBIA RIVER.

By AUG. C. KINNEY.

[From a letter by Prof. S. F. Baird.]

The State of Oregon has petitioned Congress to have the fish-traps here removed. A petition will be forwarded to-day by citizens of this place asking the Secretary of War to do this. The State of Oregon has not the right to remove them. There is no doubt that these fish-traps, projecting out into the channel as they do, have caused the loss of the lives of many fishermen who were fishing by the ordinary means of gill-nets, and that they obstruct navigation very greatly. I hope, therefore, that the Secretary of War will investigate the matter imme diately; and if found as stated, have them removed.

There are other considerations favoring the removal of these traps which I need hardly mention, but which should have force in causing their removal. The fish caught are mostly those that run in shallow water, near shore, and nearly "ripe," and hence unfit for food. Next, a great quantity of other fish are caught, quite a number of shad with others, which we are desirous shall remain unmolested for a few years, also a great number of "steel-heads"—a large trout.

I cannot see any other way of avoiding a bloody conflict between the fishermen and the trapmen. The fishermen are very much enraged at the loss of the lives of fishermen who are dragged into the traps with their nets.

ASTORIA, OREG., *March* 25, 1885.

113.—SHIPMENT OF WHITEFISH EGGS TO THE BALLARAT FISH ACCLIMATIZATION SOCIETY.

By W. P. WHITCOMBE, President.

[From a letter to Prof. S. F. Baird.]

Acting on your advice we placed the care of the consignment of whitefish eggs in the hands of Mr. Creighton, of San Francisco, who evidently did everything needful there, and the case was safely consigned by the steamship City of Sydney to Sydney, where we had requested Messrs. Gilchrist, Watt, & Co. to tranship to one of their large steamers plying between that port and London, calling at Melbourne. These gentlemen carried out our wishes, and the consignment was brought on in the steamship Liguria to Melbourne, arriving there on Monday, the 16th of February, 1885. Messrs. Gilchrist, Watt, & Co. wrote us from Sydney to the effect that all the ova except those in the top tray were in good order. With our secretary, Mr. Cooper, I proceeded to Melbourne on Monday night, and arriving at the Liguria on Tuesday morning found that a mistake had occurred. The ova had been placed in the refrigerating chamber of the Liguria, and the captain having no ice (as these ships make their own ice as required) and finding his refrigerating chamber getting, as he thought, too cold, removed the box to the coolest place he could find outside the refrigerater; but this was unfortunately much too warm, and on bringing the box on deck we found that it had a most unpleasant odor. We placed it at once in ice, and were able to commence unpacking on Wednesday, the 17th, at Ballarat. We found all ova in two top trays gone; they had hatched and become putrid; as were all in the centers of the other trays, but in the corners and at the sides we found ova apparently good; and we carefully picked these out into iced water, and placed them to the estimated number of 30,000 to 40,000 in water at a temperature of 40° in our hatching boxes. By evening it became evident that the experiment was a failure, as nearly all were hatched and dead, and by next morning all were gone. On examination with a lens it seemed that nearly all, except those we picked out, had hatched in the trays.

Should you make a further attempt I will send a trustworthy man to Sydney to take charge from there. A few hundredweights of ice would have enabled us to bring the ova by rail and thus save a day at least. Had thin slips of wood been placed between each tray so as to allow better ventilation, or at any rate to take off any pressure caused by the moss, it would have been better. The center of each tray was simply a flattened, homogeneous, greasy paste, without any trace of ovum or fish discernible; it was only at the edges and corners of the trays that there could have been any visible ova even at Sydney.

BALLARAT, AUSTRALIA, *February* 23, 1885.

NOTE UPON THE FOREGOING BY FRANK N. CLARK.

I am very well satisfied that they would have reached Melbourne in substantially the same condition in which they were received at Sydney had they not been exposed to a considerable rise in temperature between these points. The low temperature provided from San Francisco to Sydney would undoubtedly have carried them along considerably farther than to Melbourne. They were packed the same as our most successful consignments from this station to New Zealand and points less remote.

The results of my refrigerator experiments with whitefish eggs on flannel trays show that after eggs have been held some time at a low temperature (32 to 34° F.), a rise in temperature of 8 to 10°, or even 4 to 5° if the eggs are well advanced in development, will invariably cause premature hatching in a few hours if the increased temperature is sustained. The eggs simply collapse. In these experiments no weight of any kind was imposed on the eggs, nor was there a lack of ventilation, but when subjected to the increased temperature the whole egg structure would seem to weaken or relax, and collapse would follow. This is not the case with eggs recently removed from water, unless they are far advanced, but I have seen whole trays of comparatively young eggs (flannel trays, in a refrigerator) collapse in twenty-four hours on a rise of 9° after having been held thirty-two days in a temperature of 32° to 34°. It is evident, therefore, that on a journey of several weeks they should be more carefully guarded as to temperature later on than at the beginning. In this instance the weight of moss probably hastened the collapse, but a layer of moss is indispensable for a long journey, to prevent drying out, a condition that would be fatal. All the conditions for successful shipments from this place to Melbourne are easily within reach, but such shipments are out of the question unless the temperature can be carefully guarded for all of that part of the journey beyond San Francisco.

NORTHVILLE, MICH., *April* 14, 1885.

REPORT BY MR. CHARLES CREIGHTON.

Previous to my father's departure for Honolulu he desired me to report the condition of the ova upon their arrival at Ballarat, Victoria.

I am in receipt of a letter from Mr. J. Sisson Cooper, honorable secretary of the Ballarat Fish Acclimatization Society, dated February 24, in which he reports that the ova arrived in Sydney in splendid condition, but that in shipment from that port to Melbourne on board the steamship Liguria, the captain of this steamer, fearing that the ice-room was too cold, removed the ova to another part of the ship, in consequence of which they all hatched out and were destroyed.

SAN FRANCISCO, CAL., *April* 1, 1885.

114.—FISH AND MEDUSÆ.*

By A. OESTERBOL.

It is well known that certain fish and medusæ may be said to live together as good comrades, as several fish accompany the medusæ wherever they go, and seek shelter under their swimming-bell. Thus young cod frequently are found under large medusians, supposedly to seek protection from their enemies, which probably are scared by the swaying tentacles of the jelly-fish. The young of the mackerel likewise often seek shelter under large medusæ, and probably for the same reason. It is probable, however, that the young fish hide under the swimming-bell of the medusians, not only to escape the persecutions of their enemies, but also because this place of refuge affords them easier access to food. The young of fish live on microscopic animals, and this food they find in the eggs and larvæ of the medusæ when these have left the mother animal. A kind of herring, found on the coast of America, eats not only the eggs of the medusa, but nibbles at the medusa itself. It is said that mackerel, when fully grown, will follow the medusæ and eat diminutive crustaceans found on them. A species of mackerel which lives on the coast of Australia has a very sly way of seeking shelter and providing its food, as, under the swimming-bell of the medusæ, according to an observer, they are safe from their enemies, and without the least trouble are liberally furnished with the small animals which constitute their food, as the constant current produced by the medusæ carries many of these animals underneath their swimming-bells. It has also been observed that a medusa will occasionally snatch a fish, which therefore has to pay with its life for the protection which it and its comrades have enjoyed; and small sea-nettles have also been observed to eat fish-eggs.

In this connection it may be interesting to note the observations recently made by Dr. Hugo Eisig in the aquariums of the zoological station at Naples, as they throw considerable light on the remarkable relations existing between fish and medusæ.

He states that fish are frequently found under the swimming-bells of the largest two medusæ in the Bay of Naples, and that they are so inseparably connected with them that they are frequently caught with the medusæ. Even in the aquarium they continually swim round the medusians, and occasionally hide under their bells. For a long time Dr. Eisig was of the opinion that the fish accompany the medusæ only to seek shelter from danger under the swimming-bells, but further observations showed that they preyed on the medusæ. Among the companions of these medusæ Dr. Eisig observed three mackerel. A young

* "*Fiske og Meduser.*" From *Fiskeritidende*, No. 22, Copenhagen, June 2, 1885. Translated from the Danish by HERMAN JACOBSON.

mackerel, about 2 inches long, was one day placed in an aquarium with a medusa, whose swimming-bell measured about 5 inches in diameter. The next morning Eisig found that the medusa had lost all the points of its tentacles, for the fish had eaten them. Soon after that he had an opportunity to observe another fish in the act of nibbling at the medusa, so that there can be no doubt as to these facts. But that the fish did not choose this food, because there was lack of other suitable food, is indicated by the following: A larger fish, about 6 inches long, which for some time had been in a basin where there were no medusæ, took no food at all, and finally became so weak that it looked as if it was going to die. But after a medusa had been placed in the basin the languid fish became very lively, constantly swam round the medusa, and soon began to nibble at it.

Two circumstances are remarkable in this observation. In the first place these fish can sport about unharmed among the tentacles of sea-nettles which possess the power of stinging severely, while many other fish, and frequently such as are larger than those referred to, are found dead, hanging to the points of the tentacles. In the second place these fish are able to eat a substance which acts like poison on most other fish, or which is at least refused by them. Although the observations in most of the cases referred to above seem to indicate that the fish derives the principal advantage from this companionship, there is nevertheless something mysterious about this relation. It is very evident that it is an advantage to the fish to live in a place shunned by its enemies, and where it has free access to suitable food. But on the other hand it is very remarkable, and agrees but little with what is known of similar relations between other animals, that this companionship should be maintained unless it is an advantage to both parties. The most plausible explanation seems to be that the protection enjoyed by the fish is compensated by the fact that the medusa every now and then seizes and kills a fish. But what does the medusa gain by having a fish living inside its body, as has been observed in the Indian Ocean?

115.—NEW ENGLAND FISHERIES IN JULY, 1885.

By W. A. WILCOX.

If it was not for an unusually light demand and extremely low prices for all kinds of fish, the New England fisheries would be in a prosperous condition; as it is, although fish are plentiful, and vessels arrive from short trips with good fares, prices are so low that few vessels are more than paying expenses.

During the past month squid and herring have been abundant in the weirs along the Massachusetts coast, supplying the ground fishermen with plenty of good fresh bait.

During June cod were scarce on the Grand Banks, many vessels changing from there to Banquereau; during July fish were abundant on both. The catch of cod on Brown's decreased during the month, vessels changing to George's; an average catch being made on both. The total amount of codfish received at Gloucester during July (8,220,500 pounds) was an average amount for that month, although much less than for July, 1884, when 9,030,000 pounds were landed.

The mackerel catch, always changeable and uncertain, now receives the most attention. During the past month the catch and prospects have materially changed for the better. During June no body of mackerel could be found in any direction; the amount of cured fish, in sea-packed barrels, landed by the entire fleet, amounted to only 15,328 barrels. In hopes of finding them more plentiful 40 sail went to the Gulf of Saint Lawrence, the rest of the fleet of 325 sail remained scattered from Cape Cod to the Bay of Fundy. Vessels that went to North Bay found mackerel, of small size and very inferior quality, abundant about Prince Edward Island up to the latter part of the month, when few fish were seen. These vessels mostly secured fares, some forwarding the same home by rail or steamer, and continuing in the bay in hopes of securing fares of large-sized fish. The last of the month finds most of this small fleet about ready to leave the Gulf of Saint Lawrence for home, if a fare has been secured; if not, to cruise off the New England shores. Early in the month a large body of mackerel was found off Mount Desert and in the Bay of Fundy, 145 sail fishing from Mount Desert to within 15 miles of Brier Island. Medium-sized fish of poor quality were abundant, but foggy weather prevented much fishing. Contrary to the usual custom, during July mackerel appeared to be very numerous over a large extent of territory, not being confined to any particular locality.

July 2. Mackerel abundant off Nauset light, Cape Cod. Weirs at North Truro, Cape Cod, had a good catch of mackerel.

July 1 to 5. Mackerel plentiful, and many good fares secured near the South Shoal lightship off Nantucket.

July 8. Schooner J. M. Plummer arrived at Harwichport with 400 barrels of mackerel caught off No Man's Land.

July 9. Mackerel reported plentiful on German Bank and Jones Ground, Bay of Fundy. Between July 4 and 10th, schooner Lottie Hopkins secured 230 barrels of mackerel on Cashe's Banks; during the same time other vessels secured fares off Seguin and Southport, Me.

July 10. Schooner William H. Foy took 175 barrels southeast of Monhegan; a few other vessels took fish at same time and place.

July 12. Four vessels took 100 barrels each off Damariscotta, Me.; fish in schools of from 40 to 80 barrels each.

July 14. Arrivals from Mount Desert report mackerel plentiful. Schooner Alaska arrived at Southport, Me., with 270 barrels of mackerel caught off Thatcher's Island; reports fish abundant.

July 16. Arrivals continue to report mackerel plentiful on German Bank.

July 18. Two arrivals with fares secured on southwestern part of George's Bank; schooners were the Pleiades and Eddie Davidson.

July 20. Schooner Chester R. Lawrence arrived at Boothbay, Me., for salt and barrels, having 560 barrels of mackerel on board that were caught 25 miles southeast from Monhegan; reported mackerel abundant.

July 21. One arrival at Provincetown with 370 barrels of mackerel caught off Block Island.

July 22. Schooner Mertie and Delmar arrived at Harwichport with 225 barrels of mackerel caught off Block Island. Fifteen sail were left fishing at that point; these vessels mostly secured fares during the next few days.

July 23. Mackerel were plentiful east of Cape Cod. Schooner Emma Higgins arrived at Provincetown from there with 350 barrels.

July 24. Schooner Hattie Linnell arrived at Provincetown with a full fare of 450 barrels, caught east of Cape Cod the day before.

July 25. Mackerel were abundant off Highland light.

July 27. Schooner Mystery took 120 barrels off Wood End, Provincetown harbor; and schooner Willie Jewell came in with a full fare caught off Race Point, Cape Cod.

The same date, 15 arrivals at Gloucester landed 6,390 barrels of mackerel, mostly caught off the eastern shore and in the Bay of Fundy. Only 1 of the 15 had been in North Bay.

July 28. Schooner Longwood arrived at Provincetown the 27th with 400 barrels of mackerel, caught that day in Cape Cod Bay; the fish were of good size and fine quality. Twelve sail were with her; all doing well. The mackerel were working into Barnstable Bay.

The weirs at North Truro took about 5,000 barrels of mackerel during the week.

July 30. Schooner Mystery sailed from Gloucester on July 23. Arrived back at her wharf on the 29th with 540 barrels of mackerel, caught during that time. The fish were of good quality and fair size, mostly No. 2; were caught just off Race Point, Cape Cod.

July 30. During the month 7 salmon, averaging 10 pounds each, were taken from the traps in Gloucester Harbor.

This report, with names, dates, and amount of the catch, is intended merely to show the locality and abundance of mackerel off the wide expanse of the New England coast during the month. The aggregate amounts landed at all ports during the season, up to August 1, will be found in the accompanying table. It only remains to add that the prices received during the month are the lowest ever recorded. The size of the fish is an improvement on last year, and is noticeable for the few large fish that will inspect No. 1. The fish caught in North Bay or the Gulf of Saint Lawrence have been the poorest and sold the lowest of all,

bringing from $2 to $2.25 a barrel. At this price vessels could not pay expenses. Fish caught in the Bay of Fundy were of an inferior quality, yet somewhat better than those from North Bay, selling for from $2.50 to $2.75 a barrel. Fish caught in Massachusetts and Cape Cod Bays and off the New England coast, being the next best; those caught in Barnstable Bay being very fat, nice fish, selling for from $3 to $3.50 a barrel. Fish from Block Island were mostly large, many of them from 15 to 18 inches long, and of good quality. Such fish sold from $12 to $14 a barrel.

Receipts of fish at Gloucester, Mass., in July, 1885.

From—	Fares.	Salt codfish.	Fresh halibut.	Salt hake.	Salt cusk.	Salt pollock.	Salt mackerel.	Fresh mackerel.	Fresh swordfish.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Barrels.*	*Barrels.*	*Pounds.*
Brown's Bank	124	3,067,000	62,450	.....	.....	.....	.....	.....	.....
George's Bank	85	1,671,000	107,800	.....	11,000	.....	.....	.....	.....
Grand Banks	37	2,928,000	1,060,500	.....	.....	.....	.....	.....	.....
Northeast shore	19	239,500	.....	73,500	6,500	3,000	.....	.....	783
Flemish Cap	1	180,000	5,000	.....	.....	.....	.....	.....	.....
La Have Bank	1	40,000	12,000	.....	.....	.....	.....	.....	.....
Cape shore	3	108,000	.....	.....	.....	.....	.....	.....	.....
Banquereau	7	870,000	18,500	.....	.....	.....	.....	.....	.....
Northeast shore and Bay of Fundy	109	.....	.....	.....	.....	.....	32,993	.....	.....
North Bay, by vessel	6	.....	.....	.....	.....	.....	2,895	.....	.....
North Bay, by steamer to Boston	.....	.....	.....	.....	.....	.....	1,527	.....	.....
North Bay, by railroad	.....	.....	.....	.....	.....	.....	1,822	.....	.....
Off Seal Island	1	.....	.....	.....	.....	.....	400	.....	.....
From harbor traps	.....	.....	.....	.....	.....	.....	.....	563	.....
From small boats shore-fishing	.....	17,000	.....	4,000	.....	.....	.....	.....	.....
Total	393	8,220,500	1,266,250	77,500	17,500	3,000	39,637	563	783

Mackerel landed by the New England fleet, in sea-packed barrels, up to August 1.

	May.	June.	July.	Total.
Gloucester	5,579	6,626	39,637	51,842
Boston	3,255	4,503	12,396	20,154
Portland	615	1,925	19,595	22,135
Provincetown	350	1,149	4,308	5,807
Harwichport	310	390	2,325	3,025
South Chatham	200	80	1,005	1,285
Wellfleet	75	610	6,333	7,018
Boothbay	.....	45	2,165	2,210
Dennisport	.....	.....	1,030	1,030
Southport	.....	.....	2,330	2,330
Total	10,384	15,328	91,124	116,836

In 1884 there were 111,318 mackerel landed; and in 1883, 48,244.
This does not include the early catch south, landed at New York and Philadelphia.

The following is the position of the New England fishing fleet during the last week of July: 325 sail, mackerel, scattered as follows: 145 sail in the Bay of Fundy, between Mount Desert and 15 miles west of Brier Island; 40 sail in the Gulf of Saint Lawrence; 50 sail off Block Island and Cape Cod; 90 sail off Massachusetts and Maine coasts. Thirty-eight sail, halibut, on Grand Banks, latitude 44° 03′ to 44° 12′, longitude 49° 12′ to 49° 25′; 232 sail, codfish, on Grand Banks and Banquereau; 165 sail, codfish, on George's and Brown's Banks, longitude 65° 30′ to 69°, lati-

tude 41° to 43°; 12 sail, codfish, off Nova Scotia shore, latitude 43° to 43° 25′, longitude 65°; 250 sail, ground and swordfish fishing, off the New England coast; 11 sail, halibut, off Greenland and Iceland; 6 steamers, taking whales, off the New England coast; total, 1,033 sail, 6 steamers.

Capt. J. W. Collins, assistant of United States Fish Commission, having recently returned from a month's cruise to the eastern fishing banks, on the United States Fish Commission steamer Albatross, makes the following report, of special interest to the fisheries: Upwards of 2,000 fathoms were obtained in the position where Hope Bank (with a depth of 45 fathoms) has been laid down on the chart.

Researches about the eastern part of Banquereau proved that the charts of that region are inaccurate.

A series of trials with hand-lines was made on Misaine Bank, and codfish were found there in as great abundance as on any of the adjacent fishing grounds. Heretofore this bank has not been frequented by fishing vessels.

GLOUCESTER, MASS., *August* 12, 1885.

116.—NOTES TAKEN DURING CRUISE OF THE ALBATROSS TO GRAND BANKS IN JUNE AND JULY, 1885.

By WILLARD NYE, Jr.

Trout.—There are two or three varieties in the clear freshwater ponds of Newfoundland. The first is remarkably brilliant colored, and is comparatively longer, with a more pointed head. On first being taken from the water its scales look as though made of silver and gold. The second is more thickset, and much like our brook-trout, except the red spots are more irregular. This variety in Newfoundland is called mud-trout, but I could see no reason for it other than its darker color. The fishermen speak of a third variety, which is still darker.

Sticklebacks.—These were taken from a spring pond at the top of Signal Hill, at an elevation of about 300 feet. These sticklebacks seem to differ from those taken from brooks at the point where they empty into the salt water.

Whales, &c.—On July 13, twenty-four swordfish were counted from the ship in four or five hours. Most of them were very large, only two being small. Later in the afternoon finback whales were seen in all directions. They seemed to be skimming up feed from the surface. On examination, the water was found full of *Copepoda;* but a little after sunset all this small life disappeared, and not one could be caught at the surface. Several clots looking like blood were seen floating, and some were obtained in the net, which, on examination, were considered excrement of finback whales, taking its color from the deep red of the *Copepoda*. A school of large porpoises was with the finbacks, and seemed to be after the same feed.

NEW BEDFORD, MASS., *August* 10, 1885.

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117.—NOTES UPON FISH AND THE FISHERIES.

Compiled by CHAS. W. SMILEY.

[Mainly derived from the official correspondence.]

APPEARANCE OF MACKEREL.—M. R. Sampson, keeper of the United States life-saving station at Manomet Point, writing under date of July 15, 1885, says: "Mackerel have made their appearance in schools near this station, and a few have been taken with hook and line."

STRANDING OF A FINBACK WHALE AT MOUNT DESERT LIGHT STATION.—Writing under date of July 4, 1885, Thomas Milan, keeper, says: "There was a male finback whale came ashore at this station July 3. He is 56 feet long, circumference about 25 feet. The flukes have a breadth of 12 feet 1 inch; back fin, 1 foot 3 inches; depth of flukes, 3 feet 2 inches; from snout to back fin, 40 feet; length of mouth, 12 feet. The outside skin was nearly all stripped off, as he had been eaten considerably by the sharks. The color of his back was a dark lead color or nearly black; flukes, upper side, same color, under side, grayish-white."

A CODFISH BANK NEAR NOONIVAK ISLAND.—On June 5, 1884, discovered a cod bank off western end of Noonivak Island in latitude 60° 23′ 40″ N. and longitude 168° 57′ W. Depth of water on bank about 25 fathoms; bottom, sand, gravel, and rock. Again, on June 9, 1884, in latitude 60° 03′ N. and longitude 167° 58′ W., caught a large number of cod, weighing from 12 to 16 pounds. This seems to be a part of the same bank discovered June 5. Depth of water on this bank about 19 fathoms, sand and shell bottom. The fish on both occasions seemed to be very plentiful. [Extract from log of schooner Ounalaska.]

APPEARANCE OF FISH AT ATLANTICVILLE, N. Y.—David A. Vail, keeper of the Tiana Life-Saving Station, Atlanticville, N. Y., wrote, May 1, 1885: "The appearances of fish on this coast have been as follows: Alewives first appeared on February 26; porgies, April 20; sea-robins, April 22; Boston mackerel, April 30; butterfish, April 30. I have caused a watch to be kept for whale and porpoises, but have seen none. Neither have I heard of any being seen in this vicinity this spring."

June 19, Mr. Vail again wrote: "I have been unable to observe the advent of fish on the coast as closely as I desired. The inlet to our bay, which is small, is too small for fish to enter the bay, and it closed entirely on the 15th of May. During the week ending June 6 menhaden were abundant on this coast. On June 3 two whales were observed directly

off this place, apparently 8 or 10 miles from shore; when they blew the spray therefrom fell over all around like a fountain."

DRUMFISH IN BUSH RIVER.—The Harford Democrat, published in Belair, Md., August 7, 1885, announces that a drumfish had been taken in Bush River by Mr. John Leight, who has fished the river for many years, but never caught one before. It measured 31 inches in length, 11½ inches depth, and weighed 14½ pounds.

CULTIVATING THE RED-MOUTH BUFFALO-FISH.—Under date of March 2, 1885, Mr. John Farrington, of Fayette, Howard County, Mo., writes that he considers the red-mouth buffalo-fish (*Ictiobus bubalus*) to be superior to the mirror carp, having cultivated the former for several years past. Four years ago he put 12 *Ictiobus bubalus*, weighing from one-half to three-fourths of a pound, in a pond covering an area of 1 acre, with a maximum depth of 12 feet, and last summer caught 21 fish that averaged 9 pounds, their weights ranging from 7 to 13½ pounds. Mr. Farrington further states that on account of the small bones these fish should not be eaten when weighing less than 7 pounds. He says their flesh is of fine grain and of a good flavor. He is also cultivating large-mouth bass, crappies, rock bass, and pike.

SWISS FISH-CULTURE.—During the year 1883–'84 the state fish-cultural establishment at Zurich, Switzerland, raised 40,000 salmon, 10,000 salmon hybrids, 51,000 lake and river trout, 30,000 grayling, 100,000 mullets, 7,000 German muræenas, 20,000 American salmon, and 18,000 whitefish, all of which were set free in the Lake of Zurich and in the Limmat River. In the establishment of the forest of Sihl, 30,940 eggs have been used, and from the middle of January to the end of March, 1884, there have been transferred 28,000 fish obtained from these eggs. [Bulletin of French Acclimatization Society, June, 1884, p. 513.]

TROUT CULTURE IN ENGLAND.—Trout culture has made astonishing strides in Great Britain the last two or three years. Owners of fisheries are beginning to find that by far the best plan is to put in yearling or two-year-old fish. A trout of a year old will live in water in which fry cannot thrive; even if they do thrive in it, still it is better to put in older fish, as they will spawn naturally, and their offspring will be more hardy than fry bred artificially. Many millions of fry have been wasted by turning them into the open water instead of rearing them until they can take care of themselves.

Any one in doubt as to what breed of trout to put into a water for stocking purposes should procure one-year or two-year-old Loch Leven trout from Mr. T. Andrews, Westgate House, Guildford; or Mr. Silk, Burleigh Park, Stamford; or Mr. T. Ford, Caistor, Lincolnshire. [Fishing Gazette, April 4, 1885.]

TIME REQUIRED TO HATCH CARP EGGS.—Mr. John H. Brakeley states that at Bordentown, N. J., he has found carp eggs to hatch in ninety-six hours or less.

LARGE SALMON.—In the river Tay, not far from Perth, was taken, in the middle of December, 1884, a male salmon which weighed 39 kilograms (86 pounds) and measured 1.68 meters (about 5½ feet) in length. Its greatest circumference was 0.76 meter. After it was weighed and measured it was liberated again. (Norsk Fiskeritidende, part 2, April, 1885, p. 236.)

FROG-FARMING.—The Bailey Brothers, of Minneola, Sumter County, Florida, contemplate engaging in this business, and would like information as to the best method of catching frogs and preparing the meat for market.

PLANTS AND SEEDS RECEIVED AT THE CARP PONDS.—The following plants and seeds were received at the Carp Ponds of the United States Fish Commission at Washington, in March, 1885, from the Royal Gardens at Kew, London:

Seeds.—Nelumbium speciosum, *Nymphæa ampla*, *Nymphæa cyanea* (*stellata*), *Nymphæa lotus*, *Victoria regia* (50).

Plants.—Nelumbium speciosum (1), *Thalia dealbata* (1), *Sagittaria heterophylla* (6), *Villarsia nymphæoides* (1), *Polygonum amphibium* (1 bunch), *Ranunculus lingua* (6), *Nymphæa alba* (2).

AMERICAN FISH-EGGS IN ENGLAND.—Mr. Henry Ffennell, writing in Land and Water of February 28, 1885, says: "Foremost among the more interesting consignments of eggs which have been received from abroad are a large number of ova of various kinds forwarded by the American Government, through their Fishery Commissioner, Professor Baird. The United States Government has been most liberal in its presents of fish-eggs, and English pisciculturists owe it a hearty vote of thanks for giving the National Fish Culture Association an opportunity of carrying on experiments with a view of ascertaining whether the introduction of certain fish from American waters into our English, Irish, and Scotch rivers and lakes can be practically and advantageously carried out. The advisability of introducing some appears to me very doubtful, while in other cases it seems highly probable that the nature of our streams and rivers may not be suitable for the propagation of American bred fish. As to the introduction of one American fish, the *Salmo fontinalis*, I think we have now ample proof that it has proved a failure. Thousands of *fontinalis* have been turned into various waters in England, and, so far as I can gather, I do not think that in any single instance can it be said that they have been established. They appear to be of a wandering nature, and when put into any fishery they are said generally to push up stream, but I have not heard of their increase in the higher districts. A batch of some 7,000 *fontinalis* ova arrived at the aquarium on Saturday last, in fine condition.

"Among the presents of ova sent by the American Government are those of the whitefish (*Coregonus albus*), the Penobscot or Atlantic salmon, the Schoodic or land-locked salmon, the lake trout (*Salvelinus na-*

maycush), and the California salmon (*Salmo quinnat*). I doubt much if any of the above are better sporting or edible fish than our own *Salmo salar*. I may here add that the association is now prepared to distribute whitefish fry, and any one wishing for some should apply at once at South Kensington. Doubtless some of the large Scotch or Irish lakes would be suitable to them. Lord Exeter has had a number of the fry taken to Burleigh Park. Up to the present they appear to be doing well, and eventually it is proposed to turn them into the large lake. The MacLaine, of Lochbuy, also contemplates turning a number into some of his lakes in the north."

TABLE.—*Record of shad-hatching operations conducted by Lieut. W. F. Low, U. S. N., at Havre de Grace, Md., on the Susquehanna River, under the direction of the United States Fish Commission, from April 19 to June 1, inclusive,* 1883.

Date.	Eggs obtained.	Eggs lost.	Eggs hatched.		Disposition of young fish.		
			Date.	Number.	Released in local waters.	Date.	Transplanted to other waters.
1883.			1883.			1883.	
April 19	25,000	25,000	.....	.....	.....	.....	.....
April 20	30,000	2,000	May 2	28,000	28,000	May 4	.....
April 21	75,000	25,000	May 2	50,000	50,000	May 4	.....
April 28	95,000	16,000	May 7	79,000	79,000	May 10	.....
April 30	110,000	45,000	May 7	65,000	65,000	May 10	.....
May 1	40,000	5,000	May 8	35,000	35,000	May 11	.....
May 2	155,000	12,000	May 10	143,000	143,000	May 11	.....
May 3	180,000	20,000	May 10	160,000	160,000	May 12	.....
May 4	75,000	10,000	May 10	65,000	65,000	May 12	.....
May 5	240,000	28,000	May 12	212,000	212,000	May 13	.....
May 7	500,000	60,000	May 13	440,000	440,000	May 14	.....
May 8	200,000	24,000	May 15	176,000	176,000	May 16	.....
May 9	270,000	56,000	May 16	214,000	214,000	May 17	.....
May 10	175,000	50,000	May 18	125,000	125,000	May 19	.....
May 11	100,000	36,000	May 17	64,000	64,000	May 19	.....
May 12	180,000	39,000	May 19	141,000	141,000	May 20	.....
May 13	*45,000	15,000	May 20	30,000	30,000	May 21	.....
May 14	286,000	54,000	May 20	232,000	232,000	May 21	.....
May 15	32,000	3,000	May 21	29,000	29,000	May 22	.....
May 16	356,000	48,000	May 23	308,000	.....	May 24	†308,000
May 17	‡323,500	27,000	May 24	296,500	296,500	May 25	.....
May 18	226,000	39,000	May 23	187,000	187,000	May 25	.....
May 19	§1,000,000	180,000	May 24	820,000	820,000	May 26	.....
May 21	505,000	79,000	May 27	426,000	{	May 28	†300,000
					{	May 30	‖126,000
May 22	468,000	72,000	May 28	396,000	.....	May 30	‖396,000
May 23	237,000	34,000	May 29	203,000	.....	May 30	‖203,000
May 24	149,000	9,000	May 30	140,000	.....	June 2	¶140,000
May 25	65,000	5,000	May 31	60,000	.....	June 2	¶60,000
May 28	30,000	5,000	June 3	25,000	25,000	June 4	.....
May 31	38,000	23,000	June 4	15,000	15,000	June 4	.....
June 1	153,000	33,000	June 4	120,000	120,000	June 4	.....
Total..	6,363,500	1,079,000	.....	5,284,500	3,751,500	.....	1,533,000

* 27,000 eggs from fish in pool; 25,000 eggs from fish in pool hatched successfully.

† Delivered to the Pennsylvania fish commission.

‡ Of a number of eggs taken from roe after shad was dressed and impregnated with milt from males in live box, 50 per cent. came up and 10 per cent. hatched.

§ Of 55,000 eggs taken from shad that had been dead from 1 to 1½ hours, 45,000 hatched successfully.

‖ Delivered to Fish Commission car No 1.

¶ Delivered to H. E. Quinn, messenger.

SPAWNING OF AMERICAN BLACK BASS IN GERMANY.—Max von dem Borne, writing from Berneuchen, June 22, 1885, says: "My 13 black bass have spawned. I have caught 11,800 of the fry and placed them in ponds that have no other fish. I am now almost certain that this fish will be plentiful in a few years in my neighborhood."

FOOD OF CARP.—"It is almost incredible," says the *Deutsche Fischerei-Zeitung*, "that for hundreds of years man should have been engaged in the culture of an animal without knowing on what it feeds; and yet such is the case with respect to the carp. The fish is treated in the methods bequeathed by tradition, and nature is left to do the rest. One after another has said that carp feed on vegetable matter." It appears from a long and carefully carried out series of experiments made by Mr. J. Susta, director of the Wittingau carp fishery, that carp feed chiefly—indeed, he asserts exclusively—on animal food, and that what little vegetable matter it takes into its stomach is taken in by accident when the fish is grubbing after larvæ and insects. "The greenish color of the food found in the carp's stomach has given rise to the idea that it was vegetable matter; but as soon as Mr. Susta made a closer examination he got rid of the green color arising from the gall, by washing, and found the contents of the stomach to consist almost exclusively of animal remains. Carp full of food were taken from a whole series of ponds and examined, and it was proved that the larvæ of flies, small crustaceans of the *Daphnia* and *Cyclops* genera, as well as the larvæ of *Phryganidæ*, form the principal food of carp."

"It has been calculated that in one year a female *Cyclops* would become the progenitor of more than four billions of young." The various species of the genus *Cyclops* abound in inland waters all over the world. [Fishing Gazette, April 4, 1885.]

WHITE HERONS EAT THEIR WEIGHT.—Among the entertaining features of the State carp ponds are two white herons under domestication. Mr. Logan Terrell winged two of these snow-white creatures, and has for some days kept them tied to a pole with a small cord. At times he takes the birds upon his arm and conveys them to the edge of the large pond. Then, throwing in bits of cracker, he attracts myriads of shiners and roaches near the feet of the birds, who immediately begin to feed. One fish after another is caught between the beak and swallowed head foremost. It is strange that as slick as a fish is they never drop one. Each bird takes forty-five fish per day, the minnows being 4 inches long. Mr. Terrell wonders why any fish exist when such greedy foes beset them every day. [Raleigh Register, July 22, 1885.]

GRASS FOR CARP PONDS.—Dr. Rud. Hessel says that he has found carp eggs adhering in greater numbers to *Festuca fluitans* than to any other plant. "Its narrow, long, strap-shaped, thin leaves spread softly over the water's surface, as also its numerous branches in the water, affording to the fish the sought-for opportunity to deposit its eggs upon the tender leaves."

This grass is known to American botanists as *Glyceria fluitans*. It is called *Glyceria* on account of the sweet taste of the seeds. This genus is known by the common name of manna-grass. This species grows to a height of from 3 to 5 feet and has leaves about 1 foot long. It grows in shallow water and blossoms from June to August. Its spikelets contain from seven to thirteen flowers each. It is frequently found in the United States.

In addition to its usefulness in holding the eggs, it is valuable on account of the sweet seeds which drop from it into the water and are eaten by the carp. Persons owning carp ponds can frequently find it growing wild and transplant it to their ponds by securing the aid of some local botanist to identify it. In cases of uncertainty in regard to specimens supposed to be *Glyceria fluitans* it would be well to send for identification a specimen containing leaves, flower, and fruit.

CARP PLANTED IN RIVANNA RIVER.—On June 25, 1885, Colonel M. McDonald took from the carp ponds at Washington seventy-five thousand carp from three to ten days old, and deposited them without loss at Charlottesville, Va., in the Rivanna River. The oldest of the fish were from 1¼ inches to 1½ inches in length. Only a few of the fish died in transit. The river selected is a muddy stream containing no other fish, except suckers. The dams below Charlottesville prevent the ascent of bass and other predaceous fish from the James River.

HOW TO CONSTRUCT MUSKRAT TRAPS.—Mr. Charles H. Sturr, Preston, Hamilton County, Ohio, gives the following simple method of constructing a practicable and efficient trap for the capture of muskrats:

Take a barrel containing both heads. Nail a strip of board across each end near the center, and projecting far enough so that strips running lengthwise of the barrel may be nailed on them and form a platform around the barrel. Bore a number of small holes in each end of the barrel below the strips; the strips will prevent its sinking too low and getting too full of water. Then cut a square hole, 6 by 6 inches, in what will be the top of your barrel. Set it afloat on your pond, and bait with apples, carrots, parsnips, or anything the rats like. They will go in after it and cannot get out. The trap is always set, need be looked after only at your pleasure, and is easily shifted from point to point. [National Journal of Carp Culture, May, 1885.]

THE STEAMER SPENCER F. BAIRD.—Messrs. D. L. Fernald & Co., inspectors and packers of fish at Portland, Me., are building a steamer to use in the mackerel fishery. The hull will be 156 feet long, 26 feet and 4 inches wide, and 11 feet and 3 inches deep, and about 300 tons register. The cost of the vessel will be $30,000.—*March* 30, 1885.

SCHOONER SPENCER F. BAIRD.—In a letter from Port Townsend, Wash., Mr. Jas. G. Swan, under date of April 15, 1885, writes:

"Yesterday Capt. Henry Martin arrived here with a new fishing schooner of 8 tons, which he has had built for experimenting with the fisheries of Puget Sound. She is a beautiful model, a perfect little

yacht. I went to examine her this forenoon and I was much pleased with her. Captain Martin has named this little gem of a vessel the 'Spencer F. Baird.' As she is the first vessel of her size built here expressly to experiment and develop our fisheries, I told Captain Martin I thought her name a felicitous one, of good omen to his little craft, and I trust he may be so successful in his fisheries that he may induce others to engage in this industry, and the little schooner Spencer F. Baird be the beginning of an enterprise which may develop into large proportions.

"True cod have appeared in large numbers in Port Angeles harbor, a rather unusual thing. I think they will be in Port Townsend Bay in a few weeks."

FISHWAYS REQUIRED IN ILLINOIS.—An important fishway case, of which a résumé will be found on pages 266–268 of the F. C. Bulletin for 1883, has been decided in favor of the people of the State of Illinois. The decision establishes the requirement that every person who builds a dam or other obstruction across a stream in that State must erect a suitable fishway over the same.

STATISTICS OF GLOUCESTER, MASS., FOR 1884.—In 1884 the number of vessels fishing from this port was 473, of 30,283 tonnage, employing 6,436 men; capital invested in vessels and outfits, $2,125,000. The leading products for that year were 186,929 inspected barrels of mackerel, of $1,175,000 value; 553,063 quintals, equal to 61,943,056 pounds, of codfish, valued at $1,984,000; 9,029,265 pounds of halibut, of $541,665.90 value. The haddock fleet landed some 50,000,000 pounds of fish, mostly sold fresh. Of the amount and value of fish-oil we have no statistics on hand. Total investments in the fisheries, $4,759,000. (Cape Ann Breeze, May 9, 1885.)

NOTE FROM THE MCCLOUD RIVER STATION.—Mr. Loren W. Green, writing under date of August 5, 1885, says: "Salmon are very scarce in McCloud, Pitt, and Sacramento Rivers. The Hat Creek hatchery has taken no eggs as yet, and prospects are that they will take but very few, if any, as all salmon reaching Hat Creek must pass up Pitt River, and no salmon are seen in the Pitt as yet. Indians on the McCloud have never seen the scarcity of salmon compare with this season. Our trout here in the ponds are doing very well. The summer is very dry; water very low; thermometer ranging between 95° and 108° in the shade."

THE GLOUCESTER MACKEREL-FISHERY OF 1884.—The following table has been compiled from sworn statements of masters of vessels engaged in the mackerel-fishery, made to F. J. Babson, collector of customs at Gloucester, Mass. These statements were forwarded to the Secretary of the Treasury, who turned them over to the U. S. Commission of Fish and Fisheries. Nearly all of the vessels went to the Gulf of Saint Lawrence for mackerel.

Date of report.	Vessel.	Tons.	Men.	Time.	Mackerel taken in Gulf of Saint Lawrence.			Estimated loss on trip to Gulf of Saint Lawrence.	Mackerel taken elsewhere than in Gulf of Saint Lawrence.			Remarks on mackerel taken elsewhere than in the Gulf of Saint Lawrence.
					Total	Within 3-mile limit.	Value of mackerel taken within 3-mile limit.		Where.	Amount.	Value.	
1884.				*Weeks.*	*Bbls.*	*Bbls.*				*Bbls.*		
July 15	W. H. Foye	64	15	6	0	0		$3,000	Coast of Maine	313		Taken on return from the Gulf.
19	Lelia E. Norwood	74	17	3	0	0		3,000	...do	371	$1,500	Do.
22	Fred. P. Frye	80	16	8	0	0		5,000				
27	John W. Bray*	79	16	5	15	0						
30	Com. Foote	61	16	6	30	0		3,000	Off Cape Sable	180		Taken before entering Gulf. Its mackerel-fishery is of no value this season.
30	M. S. Ayer	76	16	4½	0	0		3,500	Off Mount Desert	370		Taken on return from Gulf.
30	Henry Dennis	91	16	6	138	0						The Gulf mackerel-fishery is of no value to our people.
30	Ethel Maud	77	16	1	0	0			Off Mount Desert			Full fare taken on return from Gulf. The Gulf mackerel-fishery is of no value to our fishermen.
Aug. 15	Samuel V. Colby	95	16	7	113	10	$50	2,000				
15	Gussie Blaisdell	85	16	9	20	0	6	4,000		400		Taken in 10 days.
15	Jennie Seavernes	107	16	9	55	0		4,000	Coast of Maine	400	1,800	Taken in 6 days on return from Gulf.
17	M. A. Bradley	76	16	9	25	0				1,000		Taken during September and October. Touched the Gulf late in season, but took no mackerel.
20	William H. Jordan	86	18	4	30	0		2,000	Coast of Maine	300		Taken in 10 days on return from Gulf. While in the Gulf my other vessel took 1,030 barrels of mackerel.
20	William F. Frye	74	15	9	15	5	30			1,600		Taken in 2½ months. Went into Gulf latter part of October, but took no mackerel.
20	J. W. Campbell	79	16	13	95	95	475	3,000				
21	Landseer	94	16	9	105	50	250	2,000				
25	Bartie Pierce	90	17	5	20	0						
29	Edward S. Eveleth	84	16	9	370	75	375					
30	William D. Daisley	100	17	10	130	45	180	6,000				The Gulf mackerel-fishery is of no value to our fishermen.
30	Sarah M. Jacobs	76	16	11	250	0		4,000				
Sept. 1	Fleetwing	57	15	8	0	0		2,500				The Gulf mackerel-fishery is of no value to our fishermen.
1	Robin Hood	88	16	9	250	50	250	2,000				Do.
6	Helen M. Adams	84	15	9	12	6	30	3,000				Do.
7	Hattie Evelyn	66	16	11	131	15	75	3,000				Plenty of mackerel in Gulf, but the nature of its bottom prevents use of seine. The weather was also unfavorable.

	10	Belle Franklin	76	16	10	220	110	550	1,000				
	20	Harry G. French	95	17	2	0	0			Off Mount Desert	660		Taken on return from Gulf.
Oct.	15	Emma W. Brown	74	16	20	607	30	150					
	25	Mary R. Smith	90	16	20	120	20	80	2,500				While in the Gulf one of my vessels took 4,000 barrels of mackerel on our coast.
Nov.	1	Albert H. Harding	61	15	20	320	20	100	3,000				
	3	Ralph F. Hodgdon	85¾	16	22	700	0						
	4	Ralph E Eaton	66	16	9	115	20	100	2,500				
	5	Mabel Dillaway	77	16	22	452	350	1,800					
	5	Spencer F. Baird	74	16	11	370	180	900					
	5	Lizzie M. Center	80	16	22	1,100	500	3,500					
	8	Rapid Transit	80	16	15	398	0						
	10	Volunteer	66	15	13	350	4	20					
	10	Howard Holbrook	92	17	17	550	150	750	5,000				Made 2 trips to Gulf. Its mackerel-fishery is of no value to our fishermen.
	10	Orient	89	16	26	845	150	750					
	13	Martha C	75	15	23	540	175	900					Made 2 trips to the Gulf.
	13	Gertie Evlyn	81	16	24	418	90	700	3,000				
	15	Mascot	77	16	9	135	0		2,000				
	15	Mary A. Clark	80	16	9	130	0		2,500				The Gulf mackerel-fishery is of no value to our fishermen.
	15	Commonwealth	81	16	22	700	100	500					
	15	Mollie Adams	118	18	22	800	50	400					
	15	Warren J. Crosby	107	17	18	500	100	400	5,000				The Gulf mackerel-fishery is of no value to our fishermen.
	15	Fannie Belle	80	19	20	930	150	750					
	15	Henri N. Woods	84	16	15	250	75	350	5,000				Made 2 trips to the Gulf. Its mackerel-fishery is of no value to our fishermen.
	18	Laura Nelson	85	16	17	150	0						
	18	Isaac Patch	69	15	22	375	0						
	19	P. S. Roberts	76	16	22	840	300	2,600					
	20	William V. Hutchins	59	16	7	7	0		2,000				The mackerel-fishery of the Gulf is of no value to American fishermen.
	20	Ossipee	69	15	22	218	18	100					
	20	Edward S. Eveleth	84	16	8	0	0		3,000				
	20	Electric Light	93	16	20	485	25	100	4,000				Made 2 trips to the Gulf.
	20	Ivanhoe	76	16	22	270	0						Do.
	22	W. H. Foye	64	15	6½	0	0		2,500				
	23	Pendragon	68	16	25	600	170	850					
	29	Frank A. Rackliffe	99	17	6	0	0		2,000				
	30	Henry L. Phillips	73	16	7	0	0		1,500				The mackerel-fishery of the Gulf is of no value to our fishermen.

* On our shores mackerel always move in large bodies, but when they go into the Gulf of Saint Lawrence they break up and scatter in search of food. When the hand-line was used there were from 500 to 600 vessels in one fleet, the mackerel being brought together by the large amount of bait thrown to them. No bait being used now, the mackerel-fishery of the Gulf of Saint Lawrence is valueless to American fishermen.

SUMMARY.

Number of vessels engaged in Gulf mackerel-fishery	58
Total number of tons burden	4,593
Average number of tons burden	79
Total number of men employed	933
Average number of men to each vessel	16
Number of trips made	64
Number of men employed	1,028
Total number of weeks employed	756
Average number of weeks each trip (nearly)	12
Total number of barrels of mackerel taken	15,299
Value of mackerel taken	$86,852
Average number of barrels of mackerel taken each trip	239
Value of mackerel taken each trip	$1,357.28
Average amount each man received	$84.48
Number of barrels taken within 3-mile limit	3,138
Value of mackerel taken within 3-mile limit	$18,081
Average number of barrels of mackerel taken within 3-mile limit each trip	47
Value of mackerel taken within 3-mile limit each trip	$282.51
Number of trips on which an estimated loss has been rendered	36
Estimated loss on the 36 trips	$101,500
Average estimated loss	$2,819.44
Average estimated loss each man	$175.30
Number of fares taken on shores on return home	*7
Total number of barrels of mackerel of the 7 fares	†3,537
Average number of barrels of mackerel	505
Number reported the mackerel-fishery of the Gulf as of no value	13

*One vessel took full fare; no figures given.
†180 barrels were taken off Cape Sable, just before entering the Gulf.

THE RELATION OF FISH TO SEWAGE.—Mr. Charles J. Alger, of Burlington, Vt., under date of March 8, 1885, states that in endeavoring to enlarge the water supply of that city, a point about 1,500 feet off shore in Lake Champlain was selected from which to draw the supply. It was found that a large number of smelts gathered there during the winter months, and the question is raised whether there may not be a current of sewage or of other impurities, which induces the fish to congregate. The place is located near the end of a breakwater.

SALMON IN THE CONNECTICUT.—Mr. E. G. Blackford, of Fulton Market, writing under date of May 16, 1885, says: "I received yesterday one salmon, caught at Saybrook, on the Connecticut River, weighing 18½ pounds."

SEA-LION INVESTIGATION.—Mr. Joseph D. Redding, one of the California fish commissioners, writes, August 11, 1885, that he has invited Dr. H. W. Harkness, Dr. H. H. Behr, and Mr. Adolph Sutro to investigate and report upon this question. The sea-lions occupy the bays and coast near San Francisco in countless thousands. They are very voracious, and it is alleged that they destroy hundreds of thousands of pounds of edible fish daily. The fishermen declare that their business is rapidly declining from this cause. Their curious manner of living upon the rocks about the Golden Gate, renders the sea-lions one of the curiosities of the Pacific coast. It may be thought best to protect them within a national reservation rather than to try to exterminate them. Mr. Redding intends to present an exhaustive report to the California legislature and to the U. S. Fish Commission.

CARP FOR MEXICO.—On March 14, 1885, the Fish Commission representative at New Orleans delivered to Dr. Barroeta a pail of twenty-five carp, to be taken by him to Mexico, the smallest and strongest carp of the different varieties being selected.

SMALL-MOUTHED BLACK BASS.—This fish can be taken in considerable quantities from the lake for stocking purposes from April 20 to June 15, and in decreasing quantities from June 15 to September. Application should be made to Capt. William Clark, Life-Saving Station, Capt. J. D. Pasch, or Capt. Fred Knobloch, Erie, Pa.

CARP FOR SOUTH AMERICA.—March 28, 1885, the U. S. Fish Commission sent 100 carp from 1 to 2 inches in length to Preston A. Rambo, care of John C. Uhler, M. D., Baltimore, who left for Rio Janeiro, Brazil, March 30th.

HATCHING RAINBOW TROUT.—Mr. H. J. Pierre, of Winsted, Conn., wrote, March 19, 1885, as follows: "The 2,000 California rainbow trout eggs came to hand last Saturday in first-class condition. I placed them in my hatching trough after slowly bringing them to about the temperature of my spring water, and now I think they bid fair to give an excellent product. I believe I lost only from twelve to fifteen out of the lot, which were killed by the moving."

A SHARK'S BILL OF FARE.—Mr. A. H. Myers, keeper of Quoddy Head life-saving station, wrote from Lubec, Maine, March 6, 1885:

"The specimen shark will leave Eastport by express Monday, the 9th, and will probably reach you in four days.

"Old fishermen here say it is a young one, of the liver shark family, one of the largest known here. I removed the liver and stomach and filled the cavity with rock weed and snow. I took out about 15 gallons of liver, and from the stomach, a peck of large herring and 6 yards of gill-net."

APPEARANCE OF FISH.—Mr. John F. Holmes, keeper of the Gurnet life-saving station, writing under date of July 8, 1885, says that on July 5th schools of whales and porpoises appeared near that station, and on July 7 quite a large quantity of mackerel was taken.

OTHER FISH MISTAKEN FOR CARP.—Mr. Samuel McClelland, of Salt Springs, Saline County, Missouri, reported April 13, 1885, that thousands of little fish had appeared in his carp pond, which with the best of care did not grow more than 6 inches in length, while draining the pond proved that the carp were all large, none weighing less than 4 pounds. Neither he nor his neighbors being able to decide the question, some specimens were consequently forwarded to the Fish Commission, and proved to be *Pimephales promelas* Raf., commonly known as fat-head or black-head minnow, a species very abundant in sluggish waters, from the Ohio Valley to the Upper Missouri.

INTRODUCING CATFISH INTO ENGLAND.—The London Saturday Review of July 25, 1885, in commenting upon the recent transfer of catfish from America to England, says: "It seems almost incredible that any one should introduce the accursed catfish to our shores. Yet we read with horror that a consignment of catfish has been received by the National Fish Culture Association from the Fish Commission of the United States. Is America to be allowed to export the paupers and

criminals of her brooks and rivers into our innocent waters? If mere sport is the object of the National Fish Culture Association, perhaps they intend to set a dogfish at the catfish, and enjoy the brutal pleasures of a one-sided conflict."

The writer then lets out that he is speaking in the sporting interest and not in the interest of food for the people when he says: "Of course, if the brute does not rise to fly, it will cause less annoyance to anglers of the right sort; but over here it might change its habits and acquire a passion for black gnats or March browns. As to its edible qualities, the catfish is said to resemble the eel, and that is saying enough. We have a sufficiency of eels, and need not reinforce our 'food stuffs' with catfish."

THE TIME OF SPAWNING OF OYSTERS IN RHODE ISLAND.—The following note is by Robert Pettis, of Providence, R. I., and dated August 11, 1885: "The native oysters of Providence River and Narragansett Bay, so far as I know, have all done spawning for this season. They began to spawn this year about the 18th of June (at least that was the date when I noticed the first ones that had spawned), and about the 25th of July they had all finished and the native Providence River oysters will not spawn again this season. I can furnish you with all you may want of them for $5 per barrel. At present the meats of them are very thin and poor and not very good for eating or cooking.

"The oysters planted in this river and bay from Virginia and Maryland go in and out of their spawn several times during the season, but the native Providence River only once. The natives are what we get our seed from in Providence River. The spawn from the Virginia and Maryland oysters planted here I do not think amounts to anything, as I do not think that any spawn except the native grows in this river."

Weekly comparison of the inspections of shad and herring in the Washington market during March, April, May, and June of 1879 to 1885, inclusive.

SHAD.

Week.	1879.	1880.	1881.	1882.	1883.	1884.	1885.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
March 1–5	.....	132	.....	52	28	6	.....
6–12	.....	184	.....	778	115	8	.....
13–19	.....	2,126	470	3,054	543	283	1
20–26	740	2,523	4,862	7,733	1,183	6,275	.....
27–April 2	4,711	11,699	13,881	12,567	10,646	25,740	95
April 3–9	14,037	27,740	11,489	54,740	22,165	35,655	4,494
10–16	18,900	38,145	57,019	66,129	51,771	35,256	13,937
17–23	38,260	49,529	73,439	51,710	58,667	42,454	22,194
24–30	43,860	43,103	88,630	48,206	37,777	34,138	14,440
May 1–7	58,596	52,724	84,142	40,223	32,283	24,399	31,791
8–14	45,619	38,578	49,586	22,841	20,431	13,158	20,357
15–21	36,100	29,937	36,513	19,619	13,149	8,339	9,147
22–28	23,200	14,502	25,689	14,401	9,130	3,068	6,058
29–June 4	11,640	6,627	8,744	4,846	2,205	1,838	2,501
June 5–11	11,503	3,218	3,904	2,505	1,381	494	443
12–18	3,090	.....	.....	729	.....	.....	.....
19–25	880	.....	.....	.....	.....	.....	.....
26–30	105	.....	.....	.....	.....	.....	.....
Total	311,241	329,767	458,368	350,223	261,474	231,111	125,458

HERRING.

Week.	1879.	1880.	1881.	1882.	1883.	1884.	1885.
March 1–5	.....	15,150	175	1,917	1,310	4,978	.....
6–12	.....	12,420	1,900	9,288	3,225	5,700	4,100
13–19	.....	22,810	55,044	8,221	8,841	35,301	8,646
20–26	8,700	131,322	73,129	21,090	11,946	72,119	3,154
27–April 2	69,845	142,485	113,712	118,729	50,785	100,998	159,220
April 3–9	225,539	456,093	98,991	417,718	218,950	353,666	635,978
10–16	370,000	346,698	480,018	552,810	556,986	757,114	1,226,820
17–23	341,000	828,212	1,132,422	979,311	990,392	1,294,895	2,176,088
24–30	650,200	1,044,318	1,885,363	996,674	899,715	1,032,511	1,632,609
May 1–7	827,085	1,627,568	2,080,700	1,132,945	1,055,129	1,185,808	1,549,874
8–14	640,400	1,554,432	2,185,750	627,591	598,158	486,875	1,260,669
15–21	303,000	560,670	929,923	661,689	447,703	223,294	825,009
22–28	118,400	95,948	436,441	694,479	107,088	67,602	236,074
29–June 4	47,000	12,500	133,000	202,317	24,967	9,951	89,067
June 5–11	3,600	.....	27,000	54,559	4,278	.....	6,236
12–18	450	.....	.....	8,467	.....	.....	.....
19–25	150	.....	.....	.....	.....	.....	.....
26–30	60	.....	.....	.....	.....	.....	.....
Total	3,605,429	6,850,626	9,633,568	6,487,805	4,879,473	5,630,812	9,813,544

Yearly statement of the number of shad and herring inspected in the Washington market during the thirteen years 1873 to 1885, inclusive.

Year.	Shad.	Herring.	Year.	Shad.	Herring.
1873	852,900	3,789,800	1881	458,368	9,633,568
1874	628,637	6,567,240	1882	350,223	6,487,805
1875	464,215	1,674,465	1883	261,474	4,879,473
1876	319,079	1,488,950	1884	231,111	5,630,812
1877	131,199	2,572,124	1885	125,458	9,813,544
1878	121,785	2,507,500			
1879	311,241	3,605,429	Total	4,576,457	65,501,336
1880	320,767	6,850,626			

AMERICAN TROUT IN NORWAY.*—At the suggestion of Mr. Landmark, inspector of fisheries, the Norwegian Assembly (*Storthing*) in 1882 appropriated a sum for making experiments with the so-called American trout (*Salmo fontinalis*), which, both in its home and in those countries where it has been recently introduced, is favorably known as a rapidly-growing and hardy fish, being especially adapted to cultivation in ponds and small lakes. During the following winter (1882–'83) this appropriation was used to obtain some roe of this fish from a hatching-house near New York, whence it was sent to Norway by one of the steamers of the Thingvalla line. Only a small quantity of the roe perished during the voyage, and the remainder was hatched here toward spring in a small hatching-apparatus prepared by Mr. Landmark. The resulting fry later in spring were placed in three specially-prepared ponds in the neighborhood, at Röken, Hurum, and Fron. Some days ago the fish in these ponds were examined, and it appeared that also with us the *Salmo fontinalis* had maintained its reputation for rapid growth. In one of the ponds belonging to B. Kjekstad, in Röken, the fish had reached the very unusual length, for so young an age, of 18½ centi-

* "*Amerikansk Ørret.*" A clipping from a Norwegian newspaper. Translated from the Danish by HERMAN JACOBSON.

meters and the weight of 75 grams. In the other ponds, which had more of a provisional character and are much smaller than the Röken pond, the fish certainly were much smaller, and were not so well shaped and heavy as the specimens from Röken, but they had reached the very respectable length of 13 centimeters, and seemed to be in excellent condition. This experiment, therefore, promises well for the future, and it is probable that during the coming autumn (1885) these fish will be ready to propagate, so that in the spring of 1886 some of the young fish can be placed in other waters.

CALIFORNIA TROUT PROPAGATION AT WYTHEVILLE, VA.—Mr. George A. Seagle, writing under date of January 27, 1885, reports that the two boxes of California trout eggs (50,000) received on the 24th instant from Baird, Cal., were almost a total loss; only about 14,000 live eggs being in the two boxes. They were very badly frozen; the bottoms of the cases being frozen hard, so that not a dozen eggs were saved from the last four crates, although six hours were spent in thawing them out and bringing them to the required temperature.

We still continue to get a few eggs from our own fish. I suppose we average 800 eggs per day. The first eggs of the season are hatching out nicely. One fish yielded 962 eggs, January 26th. The first eggs were taken on the 26th of December, and on the 26th of January they began to hatch. The young fish seem to be strong and in good condition.

PETITION FOR PROTECTIVE LAWS ON MACKEREL.—At a meeting of the Massachusetts Fish and Game Protective Association at the Parker House, Friday evening, January 30, 1885, Mr. E. E. Small, of Provincetown, offered the following resolution:

"That the committee on fisheries consider the expediency of petitioning Congress for the enactment of a law preventing the catching of mackerel by seiners before the 25th of May, and for a law preventing the importation of mackerel caught before that day from any foreign country."

In support of his motion Mr. Small said that every year about the middle of March the mackerel fleet went into southern waters, and along the northern edge of the Gulf Stream they met the schools of mackerel on their way to northern waters for the purpose of depositing their spawn. "These fish," said he, "are full of spawn; they are easily caught, and when caught they are destroyed in immense numbers. With every mackerel thus destroyed there are also destroyed thousands and thousands of spawn. I know that one of the largest catches on record was taken the past year. But out of the 476,000 barrels taken I am positive that at least 400,000 barrels were little tinkers, about ten inches long—fish that a few years ago would have been passed by with disdain. Unless something is done to prevent the destruction of the spawn the mackerel fishery will soon be in the same condition as the menhaden fishery is now on the coast of Maine. All the large fish will soon be exterminated. It is true that menhaden or porgies are now caught in

great numbers, but they are small fish. The large ones that were once so plentiful have wholly disappeared. If Congress would pass a law forbidding the catching of mackerel by seines before May 25th it would give the fish time to deposit their spawn, and then the young fish would have a greater opportunity to grow. Of course the State or National laws would have no effect except within three miles of the shore. But if such a law was passed, the custom-house officials could withhold a vessel's papers until after that date, and if she went out without them the crew would be liable to prosecution under the piracy laws. A similar law should be passed to protect cod and haddock, but it would do more harm than good to saddle too many sections upon the bill."

The motion was unanimously adopted, and Mr. Small was requested to favor the association with an evening's talk upon the subject of protecting salt-water fish. (Boston Journal, February 9, 1885.)

FISH IN FLORIDA WATERS.—Mr. H. R. Clarke writes from Kissimmee, Fla., February 2, 1885:

"I am taking some nice large-mouth bass here on the fly. At Tampa I took a number of squeteague, or weak-fish (called there sea trout), on the fly; largest, 3½ pounds. Also caught a rockfish (our striped bass) on small fly-casting, with light tackle, weighing 10½ pounds; both very gamy. The lakes in Central Florida are handsome sheets of clean, pure water, and abound in large-mouth bass (Oswego) and croppies, and I am astonishing the natives by catching them with fly-casting. They take them in the lake here to Hopetilige, and down the river to Kissimmee Lake, and so on to Okechobee, 225 miles to the Gulf, on trawling tackle, that weigh up to 16 pounds. My largest so far weighed 7 pounds."

DECLINE IN FISH HATCHING IN VERMONT.—Mr. L. Stone writes from Charlestown, N. H., January 16, 1885:

"Should very much enjoy hatching the 100,000 salmon eggs for Vermont waters, but having changed my base of operations in trout hatching to Plymouth, Mass., I unfortunately tore down my hatching-house here last fall. Mr. G. A. Starkey, of Troy, N. H., would be a good man to hatch them, but his place is 25 miles from Vermont, and I cannot, at this moment, think of a single hatching establishment in Vermont that is in active operation this winter."

TROUT CULTURE IN CONNECTICUT.—Mr. Richard E. Follett, writing from Worcester, Mass., February 21, 1885, says:

"I started, December 1, 1883, by building a hatching-house in which I put 100,000 eggs. I had good success in hatching and also in growing them last season, many of them now measuring from 6 to 7 inches in length. The eggs I obtained from Mr. W. L. Gilbert, of Plymouth, Mass. I have also received from him a few thousand English trout eggs that are now beginning to hatch. As I stated in my former letter, my location is Windham, Conn. I have abundance of cold spring water with ample room for ponds and out of danger from freshets."

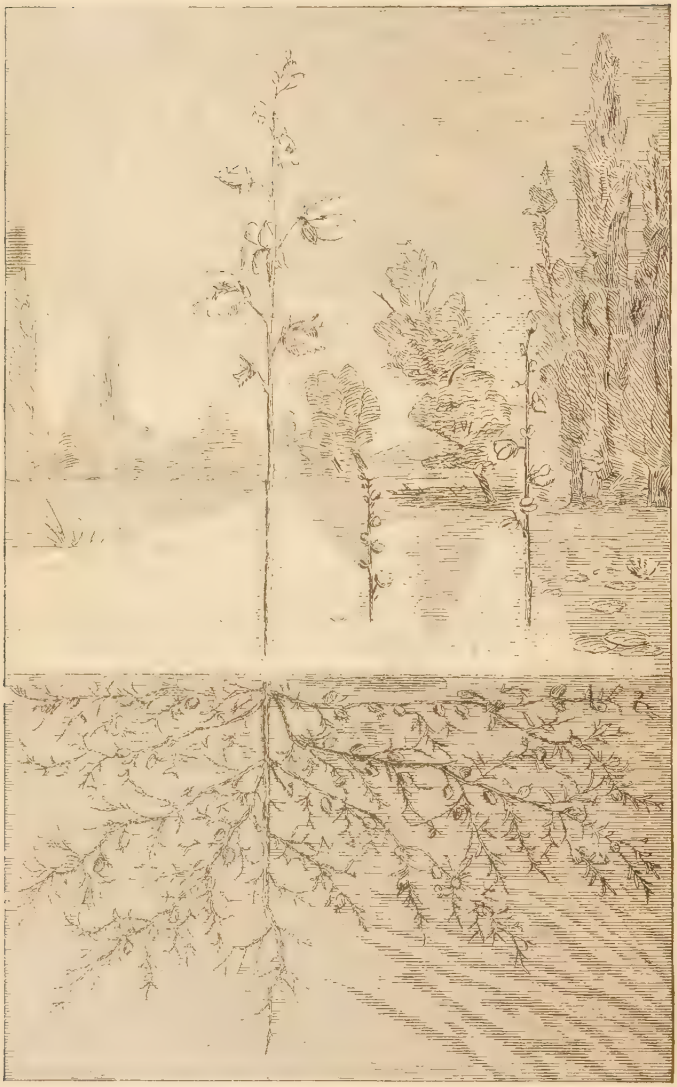
BLACK BASS SENT TO AMSTERDAM.—March 10, 1885, Mr. Blackford arranged with Captain Taat, of the Edam, for sending out by him five black bass to the Zoological Garden at Amsterdam. April 8, Dr. C. Kerbert acknowledged their receipt as follows:

"I have the pleasure of communicating the fact that I have received the five black bass in excellent condition. Many thanks for this valuable present for the aquarium of our society. You write me in your letter of March 17, 'If you want more of these fish, they can probably be supplied later in the season.' With great pleasure I accept your offer. I would like to have a tank with American black bass alone, and will try to breed these fish here in our country. On the 2d of May the Edam will start from New York for Amsterdam. Captain Taat will receive the fish in case that you have more to send at present."

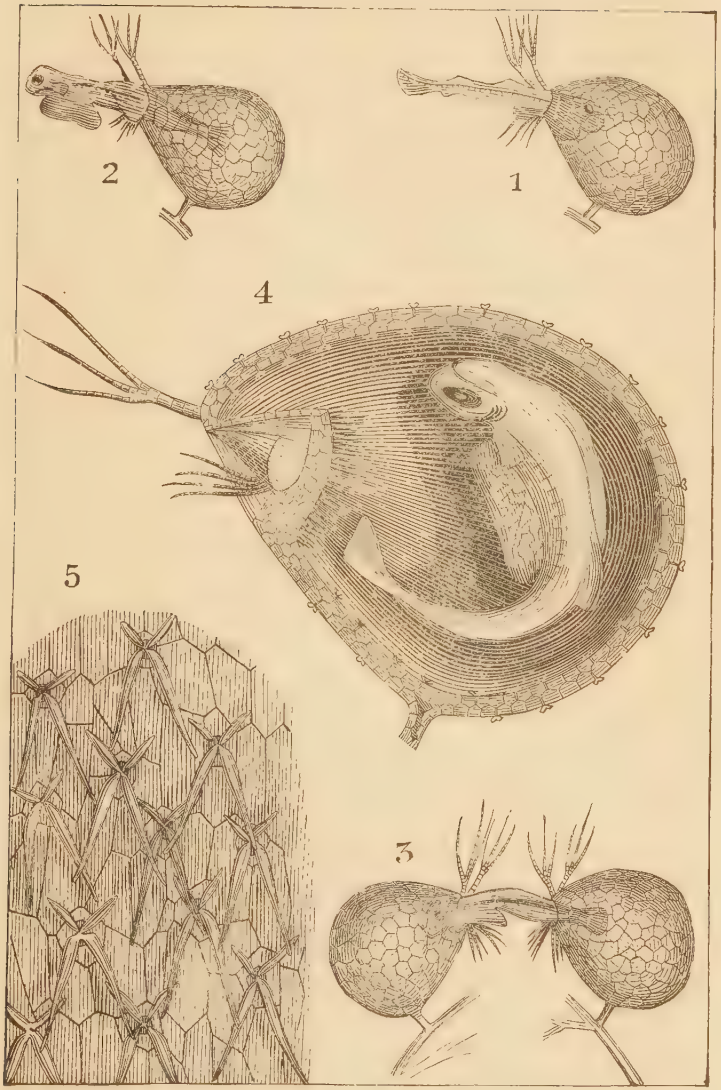
THE GREENLAND WHALE-FISHING.—The whaler Alert arrived at Lerwick yesterday from the Greenland seal and whale fishing with 30 tuns of oil. The whale fishing this year has been a comparative failure, the catches of the other vessels up to June 30th being as follows: Eclipse, 1 fish, 14 tuns; Erik, 3 fish, with seals, 70 tuns; Hope, 3 fish, with seals, 90 tuns; Earl of Mar, 80 tuns; Catherine, 35 tuns; Alert, 30 tuns; Polar Star, 40 tuns; Star, 60 tuns; Active, 25 tons; Remania, 7 tons; Intrepid, no report. The weather in Greenland this season has been moderate, the prevailing winds being easterly.

Yesterday forenoon the Norwegian vessels Franklin (Captain Andersen) and Ora (Captain Pedersen) arrived at Dundee from the Greenland bottle-nose whale-fishing. The captains report that during the fishing foggy and stormy weather was experienced; but, notwithstanding this, the crews of the Franklin and Ora secured 50 and 36 bottle-nose whales respectively. The only British vessel spoken was the Catherine, of Peterhead, which had on the 25th of May 25 bottle-nose whales and a few seals. The Ora proceeded to the White Sea fishing, but it turned out to be a complete failure, and Captain Pedersen attributes his small catch to the time he spent at these grounds. During the fishing the crew of the Ora harpooned a large-sized whale, which, after being fastened, turned round and struck the boat, sending the crew and the boat spinning into the air. The crew, however, managed to get into the boat again. Unfortunately the line which was attached to the fish broke, and the whale sunk and was lost. All the Norwegian vessels were very successful at the Greenland seal and whale fishing. The fleet, which consists of 25 vessels, secured a catch which will yield in the aggregate over 1,000 tuns of oil.

The Germania (Captain Walker), of Peterhead, arrived yesterday from the Greenland whale-fishing, bringing 14 bottle-nose whales, calculated to yield a tun of oil each. No news has been brought of other vessels since the month of May. (From the Herald, Glasgow, Scotland, July 22, 1885.)



The Fish-catching Bladderwort (*Utricularia vulgaris*).



Details of the mode of capture of a fish by the *Utricularia vulgaris*.

Vol. V, No. 23. Washington, D. C. Sept. 15, 1885.

118.—PISCIVOROUS PLANTS.*

By E. HALPÉRINE.

The so-called carnivorous plants for some years, especially since Charles Darwin† made his interesting researches, have attracted the attention of naturalists, not only on account of the curious phenomenon itself, but more particularly because of the philosophical conclusion which may be drawn from it.

It is known that the ordinary plants draw from the soil by means of their roots the nutritive inorganic elements which they need, and absorb by means of their leaves and stems the carbonic acid of the atmosphere. It has thus been said that the plants play the part of intermediate working agents, transforming inorganic matter into organic elements such as alone can serve as food for beings belonging to the animal kingdom.

Although it was already known that nitrogenous manures or fertilizers of an organic nature were just as indispensable for the formation of plants, botanists were nevertheless surprised to learn that in carnivorous plants the absorption of organic elements was no longer going on as usual by means of their roots alone, but also by their leaves, which are more or less adapted to these new functions, secreting a genuine gastric juice, and transforming organic matter by a chemical process identical with the digestion of animals.

In fact all the experience, and the facts observed by Charles Darwin and his son Francis, by Hooker,‡ F. Cohn,§ Mrs. Treat, of New Jersey, and many other naturalists, prove sufficiently the fact of animal digestion by the leaves in these plants, particularly in *Dionœa muscipula*, and in different kinds of the *Rossolis* or *Drosera*. Many other plants, like the *Aldrovanda*, *Drosophyllum*, the *Pinguicula*, and the *Utricularia*, of which we shall have to speak specially, have also been mentioned as carnivorous plants. Professor Hooker adds the *Nepenthes*, and Drs. Mellichamp and Canby also class among them the *Sarracenia* and the *Darlingtonia*. It should be observed, however, that these last two kinds, as well as the *Utricularia*, cannot, properly speaking, digest nitrogenous matter. They simply absorb the products of the decompo-

* "*Plantes piscivores.*" From *La Nature*, No. 632, Paris, July 11, 1885. Translated from the French by HERMAN JACOBSON.

† Insectivorous Plants.

‡ J. D. Hooker: Address to the department of zoology and botany of the British Association. Belfast, August 21, 1874.

§ F. Cohn: *Beiträge zur Biologie der Pflanzen.* Part III, Breslau, 1875.

sition of the animals which they capture by means of their bladders, which constitute genuine traps, acting like mouse-traps when in the air, and like fish-traps when in the water or in a very humid soil.

As regards other carnivorous plants, nothing is wanting to make the analogy of their digestion with that of animals complete. There is the preparatory act, the capture of the living prey, and the essential act characterizing digestion, namely, the dissolution of an acid and of a special juice over food of a proteinous nature; that is, food that among its component parts contains nitrogen. Numerous experiments made by many botanists, especially those made by Francis Darwin,* have clearly shown, in spite of the doubts expressed by other naturalists, that animal matter, absorbed in the manner described, enters directly into the composition of these plants, and is exceedingly useful if not indispensable to their normal development.

Among the victims commonly found in the traps of carnivorous plants, as far as known till quite recently, there were only insects and small crustaceans. But a short time ago Mr. Simms, of Oxford, brought to Professor Moseley† a vessel containing a specimen of *Utricularia vulgaris* (Plate 1), and a number of small *Leuciscus rutilus*,‡ recently hatched. Many of these small fish were dead, and were held firmly between the valves of the bladders of this voracious plant. The English professor, being interested in this remarkable discovery, procured another specimen of the *Utricularia* and a supply of eggs and young of the *Leuciscus rutilus*. Six hours later he noticed that more than a dozen of the young fish had been seized by the plant. In most cases the fish are seized by the head (Plate 2, Fig. 1), and sometimes by the tail (Plate 2, Fig. 2). One of the little fish had even been seized by the belly, and another by its two extremities by two bladders at a time (Plate 3, Fig. 3). These last-mentioned facts seem to confirm the opinion of Mrs. Treat that the carnivorous plants seize the animal of their own accord, and from this opinion she draws the conclusion that there actually exists in these plants a characteristic nervous tissue. But numerous experiments made by Charles Darwin with one of these plants, the *Drosera*, by applying to it acids, alkalies, and alkaloids of various mineral or organic salts, show too great a diversity in their results to allow us to draw therefrom any definite conclusion. Mr. Planchon says with regard to

* "Insectivorous Plants" in Nature, January 17 and June 6, 1878. In the carnivorous plants, which Darwin subjected to a meat diet, the weight of the non-blooming part attained the proportion of 121, that of the floral stems 240, that of the seed grains 380, and of the young plants produced from slips 251, while in other plants it was only 100.

† Bull. F. C., vol. iv, p. 259.

‡ The *Utricularia* is a dicotyledonous monopetalous plant, belonging to the family of *Utricularia* or *Lentibularia*. Several varieties of this plant, especially the *Utricularia vulgaris, U. neglecta, U. minor*, &c., are also found in France, and even, though rarely, in the neighborhood of Paris, in ponds in the woods of Meudon, in the forest of Compiègne, &c.

this subject:* "The physiological equivalent of nerves is perhaps found in some of the elements constituting the tissue or the cellular contents of plants, which cannot be denied *a priori;* but sensibility, properly so-called, presupposes a perception of pleasure or pain, which, without further proof, cannot be attributed to the most excitable plant."

However this may be, once seized, the victim cannot escape from the jaws of the voracious plant. The numerous glandular thorns (or "processes," as Darwin calls them) which are found on the inside of the bladder, and protrude obliquely and in the back (see Plate 2, Fig. 5), resembling the barbs of a hook, prevent the prey from escaping, and by every movement entangle it still more in this trap. After having been swallowed completely the animal begins to decompose, assumes a viscous appearance, and is rapidly absorbed by the same glandular thorns which have in the beginning aided in the capture of the little fish. This is at least the supposition at present entertained by most botanists. Mrs. Treat, however, thought she could see in the bladder of the *Utricularia* a stomach, digesting in the same manner as in the *Drosera;* but Darwin entertains grave doubts as to the correctness of this opinion, for he has observed flesh and hardened portions of the white of an egg remain for three days in the space where the little animals died, without undergoing any change. He is rather inclined to think that they died of asphysia, after having entirely consumed the oxygen of the water in the bladder. He admits, however, that some special juice may accelerate the decomposition of the dead fish, in the same manner as the juice of the papaw-tree, well-known in the tropical regions, at first softens and afterwards rapidly decomposes meat exposed to its action. Planchon says, "We have here reached the vague line where different modes of nutrition seem to combine and intermingle." Whatever the process may be, when it is once changed the animal matter enters definitely into the composition of the carnivorous plant.

The beautiful *Utricularia*, whose handsome yellow flowers form an ornament of ponds, both in the Old and the New World, is therefore a genuine piscivorous plant. But curious and interesting as the discovery of this new phenomenon in plant life may appear at first sight, it is in reality only a special illustration of a general law, a necessary adaptation to the conditions of the element in which the plant lives.

In all the so-called carnivorous plants the roots, according to the observations of Darwin, are very little developed, and scarcely suffice to draw into the plant the water and the salts found in it in a dissolved condition. It is therefore quite natural that these plants should endeavor to obtain by some other process the nitrogen which is necessary for their life, and that their leaves should aid in performing the functions which their roots cannot entirely fulfill. In reality we must say,

*J. E. Planchon: "*Plantes insectivores*" in *Revue des deux Mondes*, February, 1876, p. 648.

with Van Tieghem, that all plants are carnivorous, and we add that it cannot be otherwise, for how could we in any other way explain the various transformations and the infinite changes of matter which constitute the marvelous equilibrium of nature?

119.—NOTE ON THE CLAMS OF THE PACIFIC COAST.

By R. E. C. STEARNS.

[Letter to Prof. S. F. Baird.]

I have examined the box of clams which just came to hand from Donald Macleay, esq., president of the board of trade of Portland, Oreg.

Mr. Macleay states that they are the Eastern clams, and found at Shoalwater Bay, Washington Territory, which is correct as to their original (indirectly) and present habitat. I was aware of the presence of these clams at the locality given by Mr. Macleay, some months ago, and it would be wise to put the matter on record. Captain Simpson, a public-spirited citizen of San Francisco, of the firm of Simpson Brothers, extensively engaged in the lumber trade, employing a great many vessels in their business, informed me that he had at one time (or at various times) sent up the coast by their captains a quantity of *Mya arenaria* for planting in Shoalwater Bay, and it, *Mya*, had multiplied wonderfully, and now (at the time of our conversation, May, 1884) this clam was abundant there. The clams planted by the direction of Captain Simpson were obtained by him in San Francisco, where *Mya* now "rules the roost," its increase in San Francisco Bay and excellent quality having nearly superseded the native clams, *Tapes* (or *Cuneus*) and *Macoma;* the latter being now seldom seen on the stalls of the fish-markets.

Mya arenaria, as I have heretofore stated,* was first detected on the eastern shore of San Francisco Bay, in 1874, by Henry Hemphill, who collected some rather small and somewhat delicate specimens. These he turned over to Dr. Wesley Newcomb, then of Oakland, Cal., for examination. Dr. Newcomb regarded them as a new species which he described as *Mya hemphillii*.† The largest specimen found at that time by Dr. Hemphill was scarcely two-thirds the size of the average of those now on the market-stalls.

Following the completion of the transcontinental railroad about the year 1869–'70, some of the oyster firms in San Francisco commenced importing small oysters, *Ostrea virginica*, from the Atlantic side by the car-load for planting in San Francisco Bay, where in a season or so they attain a good merchantable size, and become exceedingly fat and of fine fine flavor. With these importations of small oysters, the spat of *Mya*

*American Naturalist, May, 1881.

†Proc. Cal. Acad. Sciences, November, 1874.

undoubtedly was accidentally and incidentally introduced to the west coast.

In 1881 Dr. Anderson, of Santa Cruz (at the head of Monterey Bay), sent me specimens from said locality, where he found them at the mouth of a lagoon. These were rather under size. It (*Mya*) was quite likely placed at this last station by some of the "shell-fish" dealers of Santa Cruz. An examination of many of the mounds and shell heaps (kitchen-middens) on the shores of San Francisco Bay and the adjacent region, has as yet failed to reveal a fragment of the shells of *Mya arenaria*, though the remains of *Tapes* (*Cuneus*), *Macoma*, *Mytilus*, *Cardium*, &c., are abundant, common, or occasional, in proportions which may be inferred from the order in which I have placed them above.

NATIONAL MUSEUM,
Washington, D. C., February 7, 1885.

120.—MEMORANDUM ON WATER RESIDUES FROM COD-HATCHING STATION AT WOOD'S HOLL.

By Dr. J. H. KIDDER.

The residues were received December 5, 1884.

A. "From receiving-tank in hatching-room," about 1 liter of water, copious black, ropy, and flocculent residue; supernatant liquid, yellowish milky. Mixture has decomposed by standing, with development of a bulky black fungus. No sulphureted hydrogen.

B. "From one of the apparatuses in which eggs are placed" about 4 ounces heavy reddish-yellow sediment; supernatant liquid, clear.

Partial analysis of the dried residue results as follows:

	Per cent.
A. Blackens on ignition (organic and volatile matters) and loses	17.74
Incombustible residue (red powder)	82.26
Total	100.00
B. Blackens on ignition and loses	24.214
Incombustible residue (red powder)	75.786
Total	100.000

The loss on ignition is mostly organic matter.

Of inorganic constituents there have been detected: Chlorine, sulphuric acid, calcium, magnesium, silica, alumina (clay), and sesquioxide of iron; the last three named constituting the greater part of the incombustible residue.

SMITHSONIAN INSTITUTION,
Washington, D. C., January 16, 1885.

121.—DISPOSITION OF WHITEFISH EGGS SENT TO SWITZERLAND.

By E. FREY, Minister.

[From a letter to Prof. S. F. Baird.]

I am directed by the federal department of commerce and agriculture to inform you that the 500,000 eggs of the whitefish which you had the kindness to deliver to my Government have arrived in good state at Bern, and have been sent with the necessary instructions and apparatus to the following fish hatcheries:

Location.	No. of eggs.	Location.	No. of eggs.
Zurich	50, 000	Grisons (Samaden)	100, 000
Bern	100, 000	Vaud (l'Isle)	100, 000
Lucerne	50, 000	Geneva	50, 000
Zug	50, 000		

At the same time I am instructed to reiterate in the name of my Government my thanks for your great kindness and courtesy, and to say that the department will be happy at any time to be at your service and disposition.

SWISS LEGATION, *Washington, D. C., February* 19, 1885.

122.—THE APPEARANCE OF SHARKS, SQUID, MENHADEN, AND FROST-FISH.

By J. M. K. SOUTHWICK.

[From a letter to Prof. S. F. Baird.]

Mr. D. T. Church, in the latter part of July last, called my attention to a fact that I think may be of interest to you, namely, that the squid were very abundant, and that a large shark taken to the oil-works was found to be full of them. No menhaden were found in him.

He says that menhaden are very plentiful from Long Island to Buzzard's Bay; and that an unusual appearance of frost-fish is noticed. Mr. Church says it is something out of the ordinary course of things for these fish to appear in our waters at that time of the year. The squid usually are most abundant earlier in the season, while the frost-fish usually appear much later. He also says that squid do attack and kill the menhaden; they envelop the heads of the menhaden with their tentacles and gouge out a piece.

I met Mr. Church later—some two weeks ago—and he told me that menhaden were very plentiful.

NEWPORT, R. I., *September* 22, 1884.

123.—PUTTING BASS INTO CARP PONDS.

By MAX VON DEM BORNE.

[From a letter to Col. M. McDonald.]

I am much delighted that the large carp ponds of Peitz were of interest to you, and I am convinced that fish ponds for carp, trout, and other fish would pay very well in America if they could be drained entirely. The last is the great secret of fish-breeding in ponds.

I am convinced that you are perfectly right that black bass will be valuable for carp ponds. Will it not be the same in all pike waters, where coarse fish are plentiful, and neither salmon nor trout are to be found? Von Behr is much afraid of the bass, but I think he is mistaken, because more than nine-tenths of all our waters in Northern Germany are only pike and coarse fish waters.*

BERNEUCHEN, GERMANY, *September* 7, 1884.

124.—EDIBLE QUALITIES OF SMOKED KINGFISH (SCOMBEROMORUS CAVALLA, Cuv.)†

By Capt. J. W. COLLINS.

All who have tasted it in my presence have conceded that the kingfish, as an article of smoked food, is as good or better than halibut prepared in the same manner. Some have compared the kingfish to salmon, while the majority think it excels halibut, because it is free from the rather rank taste that the latter has.

Captain Martin distributed some of the kingfish among the members of a club at East Gloucester, giving each a taste. He tells me that it met with great favor, the consensus of opinion being that it is superior to halibut as an article of smoked food.

We are under obligations to Messrs. William H. Wonson and Son for their kindness and courtesy in smoking the kingfish, free of charge, as well as for the extraordinary pains they have taken to cure it in the best possible manner.

GLOUCESTER, MASS., *May* 9, 1885.

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*I have suggested the introduction of black bass into ponds with three or four year old carp, with the view of keeping down the minnows which multiply in such ponds and take away the food of the carp.—McD.

†The following opinion was received by the Commissioner from Hon. William C. Endicott, Secretary of War, May 12, 1885:

"I have tried it twice. It is very palatable, and I should think it a good fish for commerce. It is not so good as the smoked halibut or the best of the herring, but much better than alewives. I have thought that our people do not eat smoked fish as much as formerly."

125.—PROPOSITION TO PREPARE KINGFISH BY SMOKING.

By Capt. J. W. COLLINS.

While at Key West I noticed that such of the kingfish as could not be sold fresh were salted. The greater part of this salted fish is dried in an unsystematic manner, and so prepared makes rather an indifferent article of food. It occurs to me that perhaps a very excellent article of food may be obtained by smoking the kingfish, which I believe may be found well adapted to this method of curing; if so, then an important result will have been obtained. The fish are abundant, can be bought for about 1 cent per pound, and consequently could be put on the market at a very reasonable figure, while, if found practicable, such a method of curing would in a large measure relieve the Key West fishermen from too great a dependence on the Cuban markets, would probably tend to enhance somewhat the price of fish, and would ultimately result in a very important addition to the fleet and men engaged in catching kingfish. The best methods of utilizing the wealth of the seas around these southern coasts seem to me a matter that deserves some attention.

As a means of making a practical test of the kingfish, I suggest that 100 pounds be procured at Key West when the ship arrives there, and brought to Washington, whence it could be sent somewhere to be smoked. The opinion of a few practical men—fish dealers, catchers, &c.—would then settle the question.

STEAMER ALBATROSS,
New Orleans, La., February 25, 1885.

126.—THE HARVEST OF THE SEA.

[From the Philadelphia Press, July 30, 1885.]

If Mulhall's statistics are reliable, there are not far short of 150,000 vessels engaged in Europe and North America in fishing. Between 600,000 and 700,000 men are employed in this industry, and the total annual product of fish is not far short of 1,500,000 tons. Few people realize the full meaning of these latter figures. A ton of fish is equal in weight to about 28 sheep, and hence, if Mulhall's estimate is approximately correct, a year's fish supply for ten European countries, included in this estimate, and the United States and Canada, might be represented by 42,000,000 sheep. Of this amount the United Kingdom, Canada, Russia, and the United States, alone, aggregate 1,000,000 tons, equivalent to 28,000,000 sheep.

It has been truly said that we talk in a metaphor of the "harvest of the sea," but we have only lately been able to realize all that the metaphor means. The Fisheries Exhibition in London in 1883 did a great deal to encourage the study of marine biology, and it is with no small

degree of satisfaction that we are able to say that in this much-needed work the United States ranks second to no other country. On the other hand, Great Britain, whose fisheries are of vital importance to her for food, has done little, and cannot yet boast a laboratory on the sea-shore. Indeed, Professor Lankester, an eminent authority on marine biology, declares the British fishing industries still barbaric. The produce of the sea is recklessly seized, regardless of the consequences of the method, the time, or the extent of depredations.

According to an English authority, the old proverb that "there are as good fish in the sea as ever came out of it" no longer holds good. The harvests of the sea in the future, like the harvests on land, will need cultivating. It was shown, not long ago, that in eight months 28 boats engaged in the haddock fishery at Ryemouth, England, used 620 tons of mussels—about 47,000,000 mussels—in the capture of haddock. Yet Professor Lankester says that no pains are taken in England to cultivate or preserve the mussel, and knowledge of its reproduction and growth is still incomplete, as it is of other bait. Soles are every year becoming scarcer, and oysters are becoming more difficult to obtain. At present, says this same authority, absolutely nothing is known as to the spawning of the sole; and the male fish is not even recognized. The reason for oysters being scarce is not known, nor how to make them abundant.

There are many economists in England who maintain that the haphazard and improvident methods of fishing are exhausting the fish supply of that country as surely as the mining is exhausting the supply of coal. The supply of many kinds of fish is rapidly diminishing, and the only way to check the waste is by systematic study of the conditions which regulate the supply. It is undoubtedly true that "the world could not be fed if men sought their food on land with as little forethought and system as fishermen cast their nets into the sea." To what extent these facts, which are causing considerable discussion in England, apply to the United States, we are not prepared to say. The excellent work for many years of our Fish Commission exonerates our Government from the charge of total neglect of this important industry. Several States have fish commissioners, and, together with the National Government, have accomplished much useful work in the artificial breeding of codfish, shad, oysters, &c. Indeed the production of fish all over the United States has undoubtedly been largely increased by scientific research. It is not improbable that the annual fish product at present in the United States is equivalent to from 4,500,000 to 5,000,000 sheep. With the increasing demand for food, and with abundant evidence from other countries of the result of neglect, we should rather increase than relax our efforts to understand more about the food, habits, spawning, and propagation of our fish, in rivers, lakes, and the sea, in order that the harvest may not grow less as the demand becomes more urgent.

127.—SALMON CANNING IN OREGON.

By EMMA H. ADAMS.

[Abstract.]

I have just made an inspection of the salmon-canning establishment of Mr. William Hume, the pioneer of that industry on the Pacific coast. He has spent his life among the salmon, having fished for them with his father in the Kennebec River in Maine, when but a lad seven years old. He introduced the business of canning on both the Sacramento and the Columbia Rivers.

In 1853 he exchanged the banks of the Kennebec for the borders of the Sacramento. In 1864 he began the new business of canning; himself; his brother, Mr. George W. Hume, now resident in Oakland, Cal.; and a Mr. A. S. Hapgood, also a New Englander, and acquainted with the process of canning lobsters and oysters on the Atlantic coast, forming a partnership for the purpose in the city of Sacramento.

At first the firm had to urge its goods on the market amidst discouragements. Canned salmon was a new article of food, and the Pacific coast families were afraid of it. "To introduce our goods," said Mr. Hume, "I used to fill a basket with cans, take it on my arm, and starting out among families of my acquaintance, give to each a can, explaining how the fish was put up, insisting that it was a valuable article of food, and inviting them to try it. That was twenty years ago. Now, canned salmon can be obtained in every market of the world. But that was the beginning of it."

Previously the shipping of fresh salmon to the gold mines in express wagons had been an important branch of Mr. Hume's trade. The miners were a class of men who would not be denied any article of food they desired, however extravagant the price. And for the tempting denizens of the Sacramento, round sums in gold were freely laid down. San Francisco also furnished a lively market for the fresh salmon.

In 1865, leaving his partners totally in the dark as to his intentions, Mr. Hume went to Oregon. The sight of the beautiful fish crowding Chinook Bay convinced him that the Columbia was the prince of salmon streams. In other words, he saw "millions in it," both of fish and dollars, and discovered that in flavor and quality the former excelled those of the American frontiers. He had formed acquaintance with men from every salmon fishery of the world, and from them had obtained a general idea of the value and extent of each; and 1868 found the brothers actively canning salmon on Oregon's splendid waterway. Mr. William Hume established himself at Eagle Cliff, on the Washington Territory side, several hours' sail above Astoria. There he has ever since resided.

Mr. George Hume's cannery in Astoria stands beside that of his brother. In former years, when operating with little or no competition in the field, a single case of their salmon, containing 48 one-pound cans each, sold for $16 in gold. Last year the estimated price was $1.15 per dozen, or $4.60 per case. For the past five years Mr. William Hume's annual pack has ranged from 26,000 to 36,000 cases. He estimates it for the present year at about 15,000, the run of fish being, for some inexplicable reason, very light. England, Australia, and the great Atlantic sea-board cities are his markets.

To day there are about forty firms and single parties taking salmon from the Columbia. Twenty-two of them operate at Astoria, all their establishments being located along the 5 miles of river brink embraced by the sprightly little city, while none of them exist above Eagle Cliff. One or two of them market no goods in this country, but send their entire pack abroad. Between Astoria and the bar of the Columbia, a distance of 15 miles, the river expands into Chinook Bay, which averages about 5 miles in width. This bay is pre-eminently salmon territory. Here, especially close within the bar, are caught a large proportion of the handsome fish, as they come in from the ocean on their way up to the freshwater tributaries of the Columbia, where their spawning takes place. The Chinook salmon is the salmon *par excellence*, and constitutes the prime brand of every prominent firm.

Chinook Bay is the place where are lost the lives of many men engaged in salmon fishing. I find great difference of opinion as to the number annually drowned. Mr. Hume puts it at fifty or more, while Mr. M. J. Kinney, of the Astoria Packing Company, places it much below that. Mr. Tallant, of the Cutting Packing Company, states that during a business term of nine years his firm has lost only one man and not a single boat.

Habits of drinking and inexperience in handling the boats and nets have been observed to be the leading causes of drowning. If, with a strong river-current running to sea and gigantic breakers rolling in, the fishermen approach too near the bar, when intoxicated, their doom is almost certain. The surf sweeps them into the deep. As a class the salmon fishers are a low order of men. They represent nearly every nationality on the globe. Having neither fixed abode nor regular employment, they migrate from place to place as hunger or impulse drives them or work offers. The worthier among them are Finns, Swedes, Russians, and Norwegians. Fishers by profession, many of them have their families here, own land, and send their children to the public schools. Some of them are estimable citizens of Astoria and the vicinity. On the other hand, the Italians and Portuguese are the rovers, the longshoremen of the calling. Since they were born they have lived on some water's edge. Not a picayune have they invested in boats or nets, and the loss of either or both is nothing to them. It is money in the pockets of the packers if their fishermen own their own

nets, as many do, having paid the firms for them in fish; as the nets are not then so liable to be stolen or damaged.

The salmon fleet of the Columbia numbers about 1,500 boats, with two men to each boat. Thus there are 3,000 men employed in a busy season. The best material for a salmon net is Barbour's twine, made at Paterson, N. J. Such is the strength of this twine that a single thread will sustain a strain of 160 pounds. The cord is made of Irish flax, imported dressed only, and therefore duty free. Brought over in the form of twine an impost of 40 per cent is levied. The cord must be exceedingly pliable, else the sensitive salmon will not enter the net. It is therefore made very slack-twisted, but a single turn of the spindle being given to an inch of the thread. Twelve subordinate threads compose the twine. Two hundred pounds of twine construct an ordinary net 45 meshes deep, each mesh 9 inches square. When in use a boiling solution of tan is poured over the nets every two weeks during the season. This cleanses them, and also imparts a color which in the daytime prevents the wary fish from perceiving the snare spread for them.

In the four large houses I visited, Chinamen were doing all the work of canning, under the direction of an American superintendent; and I believe every firm employs them. The process, consisting of not less than a dozen or fifteen different steps, requires at some stages great skill and celerity. For such work the lithe Celestial is well adapted. He is attentive, exact, prompt, faithful, and silent. Garrulous as a parrot with his countrymen usually, he is speechless if set to precise tasks, especially when his wages are to be proportioned to the amount of labor he performs. As witnessed in the establishment of the Cutting Packing Company, the work of canning exceeded in rapidity anything I have ever seen, outside the brush-making establishments in the East. All the steps were in progress in one vast room, from receiving the fish from the boats just in with their night catch, to carrying the filled cans from their cooling bath to the packing room.

The season begins in April and terminates with August. At its opening the work in some canneries is let out in departments by contract, to experienced and responsible Chinamen. These employ their own helpers, pay them by the piece, and then drive them as with the whip. Each subordinate supervises his squad of men and works himself like a Trojan, and is held responsible for faultless results. Twelve firms on the river are this year conducting their business on this plan.

Perfect cooking is the all-important step in the process of canning salmon. Failure in this respect insures fermentation and loss of the goods. The salmon is placed in the cans raw, with a teaspoonful of salt in the bottom of each. The cans are then covered, crimped, soldered, boiled in large tanks one hour by steam heat, then removed and placed for another hour in vast cylindrical iron retorts, kept heated to a temperature of 133°. This cooks the bones. Taken from the retorts, they are cooled off, cleansed from oil, lacquered, labeled, and packed.

Every step is intensely interesting. In some houses scrupulous cleanliness marks every stage of the work. Every implement, tank, and table used, as well as the floors and hands of the Chinamen, must frequently be washed. Mr. Hume even carries his notions of neatness so far as thoroughly to wash and wipe the cans before filling them. Yet, if possible, Mr. Kinney excels him in nicety. Not even the odor of fish could be detected in his establishment at the time of my call.

There were taken and canned along the Columbia last year 620,000 cases of salmon, containing 48 cans each. Complaints of a light run of fish this season are general, but the supply may be ample for all demands next year.

ASTORIA, OREG., *July* 13, 1885.

128.—SUMMARY OF FISH-CULTURAL WORK IN NORTH CAROLINA.

By S. G. WORTH.

Summary table of fish planted in North Carolina waters, 1877–'84.

Kinds of fish.	Number.
Shad planted from 1877 to 1884, inclusive	25,919,000
California salmon planted from 1877 to 1880, inclusive	748,000
Schoodic salmon planted in 1878	15,000
Brook trout planted in 1878 in North Fork of Swannanoa	50,000
German carp planted from 1879 to 1883, inclusive	39,216
Total	26,771,216

The details of the above are as follows:

Shad, 1877 *to* 1881, *inclusive.*

Tributary to—	Streams.	Total.	Plantings of the five years.					Total number in each.
			1877.	1878.	1879.	1880.	1881.	
Pamlico Sound.	Neuse	3,816,000	134,000	150,000	225,000	700,000	700,000	1,909,000
	Trent		.....	.....	125,000	200,000	.....	325,000
	Tar		50,000	250,000	200,000	790,000	270,000	1,560,000
	Contentnea Creek		52,000	.....	.....	.....	.....	52,000
Cape Fear River.	Haw River	1,940,000	70,000	.....	.....	.....	470,000	540,000
	Deep River		.....	.....	.....	600,000	.....	600,000
	Six Runs		.....	100,000	200,000	150,000	.....	450,000
	N. E. Cape Fear		.....	.....	.....	150,000	.....	150,000
	Goshen Creek		.....	100,000	100,000	.....	.....	200,000
Albemarle Sound.	Roanoke River	10,963,000	.....	389,000	350,000	150,000	.....	889,000
	Meherrin		.....	150,000	230,000	.....	.....	380,000
	Nottoway		.....	111,000	275,000	.....	.....	386,000
	Chowan		.....	200,000	.....	.....	.....	200,000
	Salmon Creek		.....	1,508,000	210,000	1,075,000	1,860,000	4,653,000
	Blackwater		.....	.....	220,000	550,000	675,000	1,445,000
	Albemarle Sound		.....	185,000	110,000	875,000	1,570,000	2,740,000
South Carolina rivers.	Yadkin	680,000	73,000	50,000	240,000	100,000	.....	463,000
	Catawba		67,000	50,000	.....	100,000	.....	217,000
Total			446,000	3,243,000	2,485,000	5,440,000	5,545,000	17,159,000

Shad, 1882 *to* 1884, *inclusive.*

Date.	Place where planted.	Stream.	Tributary to—	No. of fish planted.
1882.				
April 16	Off Avoca		Albemarle Sound	100,000
19	do		do	100,000
26	Neuse	Neuse River	Pamlico Sound	200,000
28	Fayetteville	Cape Fear	Cape Fear River	210,000
May 1	Off Avoca		Albemarle Sound	160,000
3	Rocky Mount	Tar River	Pamlico Sound	150,000
5	Neuse	Neuse River	do	150,000
8	Moncure	Cape Fear	Cape Fear	100,000
9	Off Avoca		Albemarle Sound	525,000
10	Near Warsaw	Six Runs	Cape Fear	183,000
12	Off Avoca		Albemarle Sound	250,000
12	Newport	Newport	Pamlico Sound	140,000
1883.				
April 21	Off Avoca		Albemarle Sound	60,000
24	Neuse	Neuse River	Pamlico Sound	25,000
27	Franklin, Va	Blackwater	Albemarle Sound	200,000
29	Off Avoca		do	400,000
30	Moncure	Cape Fear	Cape Fear	290,000
30	Franklin, Va	Blackwater	Albemarle Sound	78,000
May 2	Wilmington	Cape Fear	Cape Fear	240,000
3	Neuse	Neuse River	Pamlico Sound	88,000
5	do	do	do	78,000
6	Off Avoca		Albemarle Sound	345,000
7	Rocky Mount	Tar River	Pamlico Sound	198,000
7	Off Avoca		Albemarle Sound	1,315,000
9	Neuse	Neuse River	Pamlico Sound	50,000
10	Scotch Hall		Albemarle Sound	260,000
11	Off Avoca		do	60,000
12	Edenton	At Page's Fishery	do	400,000
14	Neuse	Neuse River	do	80,000
14	Snowden		Currituck Sound	260,000
1884.				
April 15	Off Avoca		Albemarle Sound	25,000
20	do		do	60,000
24	do		do	125,000
28	do		do	75,000
May 1	do		do	150,000
2	do		do	100,000
3	do		do	160,000
6	do		do	120,000
7	do		do	285,000
8	do		do	75,000
9	do		do	475,000
10	do		do	175,000
April 26 / May 10	Wilmington	Cape Fear	Cape Fear	215,000
April 29	New Berne	Neuse	Pamlico Sound	25,000

California salmon, 1877 *to* 1880, *inclusive.*

Tributary to—	Streams.	Total.	Plantings of four years.				Total number in each.
			1877.	1878.	1879.	1880.	
South Carolina streams.	Yadkin	140,000	60,000	60,000	20,000		140,000
Tennessee	Pigeon	37,000	10,000				10,000
	Swannanoa		27,000				27,000
Cape Fear	Deep	85,000	20,000	65,000			85,000
Catawba	Linville	446,000	12,000	30,000	5,000		47,000
	John's		30,000	30,000	10,000		70,000
	Catawba		50,000		5,000	160,000	215,000
	Green			30,000			30,000
	South Fork Catawba				12,000		12,000
	Clark's Creek				2,000		2,000
	Broad		25,000	50,000			76,000
Albemarle Sound	Dan River	40,000		20,000			20,000
	Town Creek			20,000			20,000
Total planting of each year			234,000	300,000	54,000	160,000	748,000

Landlocked salmon, 1878.

Date.		Number.
Apr. 5, 1878	John's River	1,000
	Linville River	4,400
	Mayo River	3,000
	Dan River	3,000
	Ponds near Charlotte	500
	Ponds near Greensborough	2,000
	Ponds near Morganton	600
	Ponds near Salisbury	1,000
	Total	15,500

Carp, 1879 *to* 1883, *inclusive.*

Year.	Distribution.	Number.
1879-'82	Distributed to 1,226 persons*	24,520
1883	Distributed to 900 persons	14,696
	Total	39,216

* Living in ninety-one of the ninety-six counties of the State.

RALEIGH, N. C., *July* 28, 1884.

129.—A FOREIGNER'S OPINION OF AMERICAN FISH-CULTURE.

By Sir LYON PLAYFAIR.

[From the Angler's Note-Book, No. VI, 1884, pp. 91, 92.)

In regard to the special subject of carp, much progress has been made in the United States by the introduction of the two German varieties. It is curious that they should have done so before the mother country, for the remains of old fish-ponds are spread over England, and are almost always near the old monasteries. Tens of thousands of old carp-ponds once existed in England, but as the carp were no longer cultivated they reverted to their wild state and became valueless. In China and Germany the culture of carp is still an important industry. The United States in introducing the culture wisely selected the German species. In 1882 the carp bred in the commission ponds at Washington were distributed in lots of twenty to ten thousand applicants in every State and Territory. The average distance to which they were sent was 900 miles, and the total milage of shipments was 9,000,000 miles; while the actual distance traversed by the transportation railway cars was 34,000 miles. Already German carp have been introduced into thirty thousand separate waters.

But I do not wish to limit my letter to carp by any means. Aquaculture has become an important affair of the State among our trans-

atlantic brethren. The separate States prosecute it, and in 1882 spent £24,000 in its promotion. The Imperial Government spent nearly £30,000 on the same object. The scale on which this is done may be indicated by the fact that the Government at Washington provided the fishery commission with two steamers, commanded by officers of the navy, and specially designed for scientific research and for fish propagation. The Albatross, of 1,300 tons, is a model of what a ship should be for the first purpose; the Fish Hawk, of 850 tons, is not good in heavy seas, but is well fitted for the latter purpose. There are seventeen hatching stations, of which the head is at Wood's Holl, in Massachusetts. Having paid a short visit to Professor Baird there this year, I am tempted to enlarge upon it; but I will only say that there is an excellent house for the staff, containing thirty beds, laboratories for research, and hatching ponds for 2,000,000 young cod. Much of the work is done by volunteer agency. The various universities send their naturalists, and the Smithsonian Institution devotes money for special researches and publications.

There is an essential difference between the mode of proceeding of the Government of the United States and that of our own country in relation to fisheries. We have had commissions without end, on some of which I have served. Vast bodies of contradictory evidence have been obtained from fishermen, who, I agree with Huxley, know less about fish than the community. Our commissions have led to little useful result. The American commissioners act in a different way. They put questions directly to nature and not to fishermen. They pursue scientific methods, and not those of "rule of thumb." They make scientific investigations into the habits, food, geographical distribution of fishes, and into the temperature of the seas and rivers in which they live or spawn. Practical aims and experiments are always kept in view. As an experiment, they tried to introduce shad on the Pacific coast and succeeded; they tried to introduce California salmon to the Atlantic slope and failed. As an instance of a practical aim, they have restocked the Sacramento and its tributaries so effectually, that the annual increase each year, for the last few years, has been 5,000,000 pounds.

The object of my letter is to show that, while the private propagator may cultivate young fish by thousands, aquaculture can only be undertaken by a government, for its statistical results must be counted up by hundreds of millions. In the United States, all the departments of the government cordially co-operate in fish-culture; the railways assist, and provincial bodies are active. In Scotland we have a fishery commission, willing and able to make experiments, but the Admiralty cannot find a vessel to make dredging experiments, and the Treasury cannot find £1,000 to carry out important researches only half complete. Biological stations in England and Scotland are being formed slowly on account of deficient public support.

LONDON, S. W., 1884.

Vol. V, No. 24. Washington, D. C. Sept. 28, 1885.

130.—REPORT OF SHAD PROPAGATION ON THE POTOMAC RIVER DURING THE SEASON OF 1885.

By MARSHALL McDONALD.

Prior to the season of 1885 the work of collecting shad eggs on the Potomac River was independently organized and under the responsible direction of an officer of the Commission, specially detailed for that service. The eggs collected were delivered at Central Station in Washington, where they were hatched and from which they were distributed to suitable waters by car and messenger service, in accordance with a program approved by the Commissioner.

In February I was placed in charge of the production of shad on the Potomac River during the season of 1885, and was instructed by the Commissioner "at the earliest possible moment to prepare the necessary plans for the same, submitting estimates of the force needed, their assignments and duties, and whatever else may be requisite to make the estimates for the expenses."

In obedience to instructions, I submitted the following program:

"*Program for the organization and conduct of shad-hatching operations on the Potomac River for the season of* 1885.

"I. THE COLLECTION OF EGGS.—It is proposed to establish the headquarters of the collecting force at Fort Washington. All eggs taken will be brought to this station and held there in circulation of water, awaiting convenience of transportation to Washington by the river steamers.

"To the equipment of the station already provided it will be necessary to add a supply tank with a capacity of twelve or fourteen hundred gallons, a steam pump and boiler, and thirty hatching jars and fixtures complete. The supply tank can be placed outside of the present building, thus avoiding the expense of additional constructions.

"The different sources from which eggs may be obtained are as follows:

"(*a*) From the fishing shores: (1) By employees of the Commission, stationed there for the purpose. (2) By the purchase of impregnated eggs at the rate of $20 per million.

"(*b*) From the gillers: (1) By the purchase of impregnated eggs at the established rate per million. (2) By employees of the Commission, equipped and detailed for the purpose.

"(*c*) From the Fort Washington seine, manned and operated by employees of the U. S. Fish Commission.

"It is proposed to have recourse to all the sources of supply above indicated, and to occupy with the collecting force the whole river from Chapman's Point to Washington. Should it be found expedient or necessary to employ the Fish Hawk on the Potomac River, it will be best to station her at Chapman's or Glymont, and assign as her field of operations all the shores and gillers below and including the Pomonkey fishing shore. The vessel should be used as an auxiliary collecting station, and the eggs taken should be shipped direct from Glymont to the Central Station, Washington.

"II. TRANSPORTATION OF EGGS.—It is not necessary or desirable that any special means of transportation from the collecting stations to Washington should be provided. The steamer Corcoran, in her daily trips to Mount Vernon, furnishes every desirable facility and convenience. The eggs should be held at the collecting stations in circulation of water from twenty-four to forty-eight hours. In this time most of the dead and unimpregnated eggs will have been cleaned off, and at this stage of development the live eggs may be transported on trays with little or no loss, and will reach Central Station in first-rate condition.

"It is important that the eggs during transit should be in the personal charge of a messenger. He may be detailed from the employees of Central Station, the detail being varied from time to time to suit the convenience or exigencies of the work.

"For the service of the collecting force there will be needed certainly one steam-launch (preferably a Herreshoff). The work of collecting eggs is very exacting and must be performed without regard to hours or weather, and since the disabling of the launch and the necessity of repairs would seriously embarrass the work if we have but a single one, I would recommend that provision be made for two. The second, when not needed otherwise, will be available for the necessary work of inspection or investigation.

"III. PROPAGATION.—All eggs obtained from the auxiliary or collecting station will be sent to Central Station for incubation and hatching.

* * * * * * *

"I respectfully submit herewith a plan of organization of the *personnel* of the work, and an estimate of the expenditures necessary to conduct the work in accordance with the program submitted.

"The entire expenditure will not exceed $6,000, and it is probable that such economy may be practiced in the organization and conduct of the work as to reduce the entire expenditure for the season below $5,000."

The program submitted was approved by the Commissioner, who authorized an expenditure not to exceed $5,000 in carrying out the plan of operations proposed.

FORT WASHINGTON STATION.

Immediately after taking charge of the work I made an inspection of the Fort Washington Station, and, after examining its facilities and convenience for the work, determined upon the erection of an additional building to be appropriated exclusively to holding the eggs in good condition until convenient to ship them. Plans for a building 16 feet by 22 feet were at once prepared, its erection contracted for, and the structure completed and equipped for work in time to receive the first eggs taken.

A steam pump, with a capacity of 100 gallons per minute, drew the water from the river and forced it into a 2,400-gallon tank, from which it was distributed to thirty of the automatic hatching-jars conveniently arranged on tables in the interior of the building.

Mr. James Carswell, who had so efficiently conducted the work of collecting for the two seasons immediately preceding, was placed in charge of Fort Washington Station, and directed to organize his force and make all necessary arrangements preliminary to occupying the station.

March 30 the shore was occupied by Mr. Carswell with four men of his force. The others were called in as the emergencies of the work required. The fishing shore was cleaned up, the seine rigged, and everything in order for work by April 5.

There being no prospect of shad in the river, the seine was not regularly fished until April 16th; only five shad were taken prior to April 20, at which date fifteen were taken, among them one ripe female, furnishing 20,000 eggs; the temperature of the river at this date being 52° Fahr. After the 20th the temperature steadily rose, reaching 60° on the 24th, when 107,000 shad eggs were obtained from the Fish Commission seine.

The following extract from Mr. Carswell's report gives a general review of the progress of the work:

"On May 4 the run of shad had greatly increased, and I was averaging 750,000 eggs per night; but on the 6th and 7th of May the largest amount for the season was secured, nearly three and one-half millions being taken on those two nights.

"Up to the 28th of May a fair average was maintained, but from this date there was a gradual decrease, and the last eggs were taken on the 6th of June, the total for the season being 22,576,000.

"The number of shad taken during the season of 1885 in the Potomac River is the smallest for a number of years."

The aggregate of 22,576,000 shad eggs obtained for the season was derived as follows:

From the Fish Commission seine	7,280,000
From Greenway fishing shore	432,000
From Moxley's Point fishing shore	4,228,000
From Ferry Landing fishing shore	2,536,000

From Pomonkey Point fishing shore	333,000
From Tent Landing fishing shore	796,000
From Chapman's Point fishing shore	1,610,000
From the gillers	5,361,000
Total	22,576,000

Interesting details showing the fluctuations in production during the season will be found in Table I.

TABLE I.—*Showing the number of shad eggs collected from the different fishing shores on the Potomac River, season of* 1885.

Date.	Fort Washington.	Greenway.	Moxley's Point.	Ferry Landing.	Pomonkey Point.	Tent Landing.	Chapman's Point.	Gillers.	Total.
April 20	20,000								20,000
April 21	25,000	15,000							40,000
April 22	15,000			15,000					30,000
April 23	75,000	25,000	10,000	35,000	12,000				157,000
April 24	107,000		45,000		14,000			75,000	241,000
April 25	66,000		70,000		48,000			85,000	269,000
April 26	288,000		72,000					34,000	394,000
April 27	102,000		45,000	35,000		56,000			238,000
April 28			136,000	28,000		56,000	56,000	193,000	469,000
April 29	179,000							42,000	221,000
April 30	28,000		12,000	10,000		20,000	56,000		126,000
May 1	100,000	42,000	35,000	242,000			65,000	119,000	603,000
May 2		49,000	45,000	95,000			14,000	252,000	455,000
May 3	175,000		56,000	95,000				220,000	546,000
May 4	163,000		98,000	160,000		91,000	222,000	105,000	839,000
May 5	126,000	140,000	84,000	462,000			250,000	490,000	1,552,000
May 6	329,000	77,000		637,000	217,000	41,000	422,000	249,000	1,972,000
May 7	55,000		14,000	109,000				85,000	263,000
May 8	399,000	21,000	191,000	375,000		112,000	98,000	133,000	1,329,000
May 9	277,000	45,000	198,000	150,000				149,000	819,000
May 10	439,000		336,000			49,000		324,000	1,148,000
May 11	536,000		424,000	28,000	42,000	63,000	20,000	420,000	1,533,000
May 12	207,000		337,000			91,000	28,000	177,000	840,000
May 13	179,000		154,000	35,000		119,000		332,000	819,000
May 14	50,000		63,000			77,000		160,000	350,000
May 15	46,000		35,000	7,000		21,000	266,000	160,000	535,000
May 16	150,000		21,000					101,000	272,000
May 17	187,000	18,000	10,000					319,000	534,000
May 18	102,000						20,000	226,000	348,000
May 19	139,000						75,000	195,000	409,000
May 20	165,000						18,000	155,000	338,000
May 21	290,000		140,000	18,000				25,000	473,000
May 22	326,000							99,000	425,000
May 23	234,000		250,000					20,000	504,000
May 24	145,000		225,000					28,000	398,000
May 25	250,000		276,000					103,000	629,000
May 26	181,000		135,000					25,000	341,000
May 27	85,000		170,000					90,000	345,000
May 28	239,000		174,000					50,000	463,000
May 29	304,000		215,000					21,000	540,000
May 30	70,000		152,000						222,000
May 31	119,000								119,000
June 1	30,000								30,000
June 2	60,000							50,000	110,000
June 3	110,000							50,000	160,000
June 4	58,000								58,000
June 5	50,000								50,000
Total	7,280,000	432,000	4,228,000	2,536,000	333,000	796,000	1,610,000	5,361,000	22,576,000

In connection with the operation of the Fish Commission seine an accurate record was kept each day. The total number of shad taken, the number of males, the number of females, the number of ripe females, the number of eggs taken and impregnated, and the temperature of the

water (in degrees, Fahr.) at the time of impregnation are shown in detail in Table II.

TABLE II.—*Record of seine hauling at the Fort Washington shore, season of* 1885.

Date.	Number of shad caught.	Males.	Females.	Ripe females.	Number of eggs taken.	Temperature of water during impregnation.	Date.	Number of shad caught.	Males.	Females.	Ripe females.	Number of eggs taken.	Temperature of water during impregnation.
April 16..	2	2	0	0	0,000	46	May 13..	106	45	61	3	179,000	61
April 17..	2	1	1	0	0,000	46	May 14..	84	33	51	1	50,000	62
April 18..	1	1	0	0	0,000	47	May 15..	60	18	42	2	46,000	63
April 19						49	May 16..	90	21	69	6	150,000	65
April 20..	15	7	8	1	10,000	52	May 17..	76	21	55	6	187,000	64
April 21..	13	8	5	3	25,000	57	May 18..	72	23	49	5	102,000	67
April 22..	28	20	8	1	15,000	58	May 19..	63	27	36	5	139,000	67
April 23..	67	34	33	4	75,000	58	May 20..	18	12	6	5	165,000	70
April 24..	28	11	17	4	107,000	60	May 21..	31	17	14	11	290,000	71
April 25..	54	30	24	3	66,000	60	May 22..	73	47	26	11	326,000	69
April 26..	39	23	16	9	288,000	61	May 23..	101	45	56	11	234,000	69
April 27..	58	24	34	5	102,000	62	May 24..	80	28	52	5	145,000	70
April 28..	31	18	13	0	0,000	62	May 25..	60	26	34	9	250,000	70
April 29..	31	15	16	8	207,000	62	May 26..	59	21	38	8	181,000	70
April 30..	47	17	30	0	0,000	63	May 27..	25	9	26	3	85,000	71
May 1...	39	18	21	2	52,000	61	May 28..	79	31	48	9	239,000	70
May 2...	30	24	6	1	48,000	61	May 29..	51	17	34	11	304,000	71
May 3...	53	33	20	5	175,000	59	May 30..	49	37	12	2	70,000	70
May 4 ..	108	71	37	3	163,000	61	May 31..	45	15	30	4	119,000	71
May 5 ..	111	66	45	4	126,000	62	June 1...	12	1	11	1	30,000	72
May 6...	69	25	44	12	329,000	62	June 2...	27	6	21	2	60,000	72
May 7...	100	51	49	2	55,000	61	June 3...	33	4	29	3	110,000	73
May 8...	140	92	48	14	399,000	63	June 4...	17	2	15	2	58,000	73
May 9...	47	16	31	9	277,000	62	June 5...	19	3	16	1	50,000	74
May 10..	86	46	40	14	439,000	61	June 6...	1	0	1	0	0,000	72
May 11..	105	44	61	16	536,000	61							
May 12..	61	28	33	6	207,000	64	Total ..	2,696	1,234	1,462	252	7,280,000	

A review of the record furnishes the following conclusions:

(1) That at no time during the season were the males in marked preponderance over the females.

(2) That for the entire season the number of females was considerably in excess of the number of males, the relative percentage being, females, 54.3 per cent; males, 45.7 per cent.

(3) The proportion of ripe females in the entire number of shad taken was 9 per cent; the proportion of ripe females in the entire number of females taken was 17 per cent.

(4) The average yield of eggs per ripe female was 28,888, the number ranging from six thousand to one hundred and two thousand.

Conclusion four is, probably, generally applicable to the shad in the Potomac River. Conclusions one, two, and three can be held to apply only to the Fort Washington shore. A discussion of like data obtained from other shores would possibly lead to conclusions widely different.

CENTRAL STATION.

In connection with the main work of the station, special attention was given to devising a successful method for hatching the adhesive eggs of the herring, including *Clupea mediocris*, or hickory jack. Every

form of apparatus that ingenuity could devise was used without success, and unless the failure is to be attributed to the low temperature of water prevailing during the course of the experiments (the range of temperature being 50° or below), I am utterly at a loss to explain our want of success.

The shad eggs after being taken were held at Fort Washington Station from 12 to 36 hours, and then were forwarded by the steamer Corcoran, in charge of a special messenger, to Central Station, where they were hatched, and from which they were distributed by car and messenger service.

The total number of eggs produced at the collecting station at Fort Washington, as measured at the station, was 22,576,000. Of these 21,019,000 were forwarded to Central Station, and the rest, yielding 1,000,000 fry, were hatched out at the station and planted in the Potomac at the mouth of the Piscataway River. Of the entire number sent to Washington 16,536,000 reached the station in good condition, and yielded 14,791,000 shad fry for distribution.

A separate record was kept of each lot of eggs, so as to furnish a complete history of it from the time the eggs were taken until they were distributed from Central Station. The detailed record will be found in Table IV. The time and temperature data can be relied upon as accurate only in the case of eggs furnished from the commission seine.

By reference to this table it will be seen that under precisely the same conditions of temperature, so far as recorded, the period of time from impregnation to hatching varies from a few hours to several days. It is evident that the period of incubation does not simply vary inversely to the temperature as indicated by the thermometer under which incubation proceeds, as I have been led to conclude from observations heretofore made.

The rate of development is not determined by the temperature at which impregnation takes place, since we find considerable differences in the period of incubation when the temperature of impregnation is precisely the same.

We know that in damp and cloudy weather the rate of development is slowed down, that in direct sunlight it receives marked acceleration, and to a less degree by reflected light in clear, bright weather. After all, this may be the indirect effect of increased temperature, since either the direct or reflected heat rays would pass through the flowing water without producing any sensible rise of temperature in it, but would be absorbed by the eggs and accelerate their development just as would result if the temperature of the water itself were to rise.

The earlier runs of shad habitually spawn in a lower temperature than those that come later in the season. It may, therefore, well be that a difference in the rate of development of different lots of eggs may come by inheritance.

An investigation of the conditions other than temperature which modify or influence the rate of development in the eggs of shad and other species of fish would furnish the subject of a fruitful biological study, which would probably have important practical applications.

In Table III, prepared by W. F. Page, superintendent of propagation, Central Station, will be found a very interesting summary, giving the average period of hatching under different temperatures from 53.5° to 75.5°. From this it will be seen that while there is considerable variation in the period of hatching in different jars under the same conditions of temperature, yet the average time of incubation at a given temperature is longer the lower the average temperature prevailing during incubation.

TABLE III.—*Summary of the period of incubation of 485 jars of shad eggs hatched at Central Station, U. S. Fish Commission, during 1883, 1884, and 1885.*

Average temperature (degrees of Fahrenheit) of hatching water.	Period of incubation.						Number of jars hatching at this temp't're.	Average per centage of eggs lost per jar.
	Maximum.		Minimum.		Average.			
	d.	h.	d.	h.	d.	h.		
From 53.5 to 54.5	13	16	13	16	13	16	1	99.9
From 54.5 to 55.5	13	18½	9	9	11	23⅝	6	55.3
From 55.5 to 56.5	13	23	8	⅛	11	23⅝	21	45.7
From 56.5 to 57.5	11	23	11	23	11	23	1	60.0
From 57.5 to 58.5	11	11	8	19	10	3	2	49.0
From 58.5 to 59.5	10	22½	10	10	10	15 1/12	11	26.6
From 59.5 to 60 5	10	22	7	11½	9	10⅝	19	21.7
From 60.5 to 61.5	9	22	8	18½	9	3½	10	17.1
From 61.5 to 62.5	10	15	7	15½	9	3 1/12	23	32.7
From 62.5 to 63.5	9	12	6	6½	7	23⅝	42	39.0
From 63.5 to 64.5	8	11	6	10	7	16⅝	74	22.0
From 64.5 to 65.5	8	12	5	12	6	18½	111	24.1
From 65.5 to 66.5	7	14	4	16	6	8	72	22.2
From 66.5 to 67.5	7	8⅓	6	3	6	18⅓	3	13.6
From 67.5 to 68.5	6	12⅓	5	1	5	14⅓	15	13.5
From 68.5 to 69.5	5	22	4	20½	5	1⅛	17	8.7
From 69.5 to 70.5	6	18	4	20⅓	5	12⅓	33	9.1
From 70.5 to 71.5	5	18	4	10	5	5½	20	20.0
From 71.5 to 72.5	4	21	4	21	4	21	2	21.0
From 72.5 to 73.5								
From 73.5 to 74.5								
From 74.5 to 75.5	4	3	4	3	4	3	2	3.5
	13	23	4	3	8	4⅝	485	29.96

The above 485 jars represent a total of 34,323,000 shad eggs.

All who have been connected with the work of shad production have had occasion in different seasons to note the variations in the date when we first begin to get ripe eggs in any quantity, in the date at which production reaches the maximum for the season, and in the period at which the season closes. This is instructively shown by W. F. Page in Table VI. It will be seen from that table that the season of 1885 was remarkably late. No eggs were taken up to April 25. On the corresponding date in 1884 the aggregate collected was 2,246,000, and in 1883 1,365,000. The season of 1884, which yielded the largest number of eggs, terminated on May 24, while the seasons of 1883 and 1885 extended to June 8.

TABLE IV.—*Comparative statement of the number of shad eggs received at Central Station, U. S. Fish Commission.*

Date.	1883.		1884.		1885.	
	Received in past 24 hours.	Total received to date.	Received in past 24 hours.	Total received to date.	Received in past 24 hours.	Total received to date.
April 15	12,500	12,500	30,000	30,000		
16	25,000	37,500	45,000	75,000		
17	187,500	225,000	155,000	230,000		
18	82,500	307,500	60,000	290,000		
19	417,500	725,000	255,000	545,000		
20	45,000	770,000	225,000	770,000		
21	233,000	1,093,000	277,000	1,047,000	3,000	3,000
22	190,000	1,193,000	(*)		(*)	
23	172,000	1,365,000	1,199,000	2,246,000	(*)	
24	(*)		(*)		(*)	
25	70,000	1,435,000	573,000	2,819,009	125,000	128,000
26	(*)		590,000	3,409,000	205,000	333,000
27	(*)		205,000	3,614,000	(*)	
28	40,000	1,475,000	90,000	3,704,000	550,000	883,000
29	(*)		817,000	4,521,000	186,000	1,069,000
30	(*)		810,000	5,331,000	210,000	1,279,000
May 1	68,000	1,543,000	508,000	5,839,000	(*)	
2	20,000	1,563,000	1,255,000	7,094,000	215,000	1,494,000
3	209,000	1,772,000	810,000	7,904,000	92,000	1,586,000
4	325,000	2,097,000	775,000	8,679,000	500,000	2,086,000
5	399,000	2,496,000	465,000	9,144,000	400,000	2,486,000
6	167,000	2,663,000	475,000	9,619,000	492,000	2,978,000
7	300,000	2,963,000	1,010,000	10,629,000	685,000	3,663,000
8	1,294,000	4,257,000	460,000	11,089,000	2,004,000	5,667,000
9	691,000	4,948,000	625,000	11,714,000	75,000	5,742,000
10	505,000	5,453,000	650,000	12,364,000	210,000	5,952,000
11	519,000	5,972,000	420,000	12,784,000	1,573,000	7,525,000
12	920,000	6,892,000	(*)		817,000	8,342,000
13	820,000	7,712,000	835,000	13,619,000	1,086,000	9,428,000
14	342,000	8,054,000	(*)		550,000	9,978,000
15	792,000	8,846,000	380,000	13,999,000	492,000	10,470,000
16	284,000	9,130,000	812,000	14,811,000	235,000	10,705,000
17	649,000	9,779,000	605,000	15,416,000	413,000	11,118,000
18	767,000	10,546,000	625,000	16,041,000	(*)	
19	758,000	11,304,000	520,000	16,561,000	598,000	11,716,000
20	900,000	12,204,000	580,000	17,141,000	321,000	12,037,000
21	600,000	12,804,000	245,000	17,386,000	(*)	
22	735,000	13,539,000	555,000	17,941,000	348,000	12,385,000
23	675,000	14,241,000	435,000	18,367,000	366,000	12,751,000
24	391,000	14,605,000	415,000	18,791,000	898,000	13,649,000
25	297,000	14,902,000	(*)		(*)	
26	100,000	15,002,000	(*)		362,000	14,011,000
27	158,000	15,160,000	(*)		383,000	14,394,000
28	410,000	15,570,000	(*)		588,000	14,982,000
29	294,000	15,864,000	(*)		669,000	15,651,000
30	525,000	16,389,000	(*)		320,000	15,971,000
31	180,000	16,569,000	(*)		411,000	16,382,000
June 1	50,000	16,619,000			80,000	16,462,000
2	315,000	16,934,000			(*)	
3	550,000	17,484,000			(*)	
4	173,000	17,657,000			34,000	16,496,000
5	(*)				(*)	
6	(*)				(*)	
7	(*)				40,000	16,536,000
8	105,000	17,762,000			(*)	
Total		17,762,000		18,791,000		16,536,000

* None.

The aggregate production of eggs did not vary greatly in the three seasons, but the production of young for distribution was larger in the season just closed than in either of the preceding.

SUMMARY.

The following is a summary of the work, so far as it came under my direction:

The aggregate furnished for distribution was	20,732,000
Lost on the way	1,861,000
Actually planted	18,871,000

These were furnished as follows:

By the Susquehanna River station (Battery Station)	5,224,000
By Potomac River stations (Central Station and Fort Washington)	15,508,000
Total	20,732,000

In making the distribution care has been taken to stock liberally the Potomac, the Susquehanna, and most of the minor tributaries of the Chesapeake. Plants of 250,000 to 1,250,000 have been made in streams in Pennsylvania, Maryland, and Virginia, which it was supposed would furnish suitable nurseries for the young fry during the first summer of their life.

The aggregate of the plants in the tributaries of the Chesapeake was about	8,000,000
In tributaries of Narragansett Bay	825,000
In Hudson River	1,250,000
In tributaries of Albemarle Sound	1,500,000
In streams draining into the South Atlantic	1,475,000
In the Mississippi and minor tributaries of the Gulf of Mexico	4,325,000

The experiment of stocking with shad the Colorado River of the West, which was begun in 1884, has been continued this season, and 848,000 were sent out by car No. 2, in charge of George H. H. Moore, and planted in good condition. Should this experiment prove successful, the shad fry deposited in 1884 should reappear as mature fish in the spring of 1887 or 1888.

It is believed that the rivers of the Seattle region of Washington Territory, draining into Puget Sound, can be successfully stocked with shad, and be made to furnish profitable fisheries, the importance of which to that region can be scarcely overestimated. With the view of making the experiment, 900,000 vigorous fry were selected and sent out by car No. 2, in charge of Mr. George H. H. Moore, one of the most experienced and careful messengers of the commission. The experiment was hazardous, because the number of days required for uninterrupted transit from Washington, D. C., to Seattle, Wash., marks the limit of time during which the shad can be transported with safety. A detention of three days by the washing away of a bridge resulted in almost total loss, only 50,000 being alive when the car reached Portland, Oreg. These were planted in the Willamette River, at that point.

WASHINGTON, D. C., *September* 15, 1885.

TABLE V.—*Daily register of eggs received and fish hatched at Central Station, U. S. Fish Commission, season of 1885.*

No. of record card.	Eggs taken.		Eggs received.		Whence obtained.	Temperature of water used in impregnating the eggs.	Total number received.	Number received alive.	Number of fish produced.	Disposal of eggs while hatching.	Period of hatching.				Temperature during incubation.			Days and hours in incubating.
	Date.	Hour of day.	Date.	Hour of day.							Began.		Ended.		Max.	Min.	Av.	
											Date.	Hour of day.	Date.	Hour of day.				
		h. m.		*h. m.*								*h. m.*		*h. m.*				*d. h.*
1	Apr. 20	13 45	Apr. 20	16	Fort Washington seine	55°	5,000	3,000	None.	B 1								
2	Apr. 21	17	Apr. 22	16	do	57°	35,000	None.										
3	Apr. 21	20	Apr. 22	16	Fort Washington Station		20,000	None.										
4	Apr. 23	7	Apr. 24	15 30	Fort Washington seine	57°	70,000	50,000	40,000	B 1	Apr. 28	21	May 2	9	62	58	59.8	8 26
5			Apr. 24	15 30	Fort Washington Station		100,000	75,000	65,000	B 2	Apr. 28	21	May 3	20	62	58	59.8	
6	Apr. 24	18 30	Apr. 25	16	Fort Washington seine	60°	110,000	75,000	70,000	B 3	Apr. 29	11	May 2	16	62	58	59.8	7 21½
7	Apr. 24	20 30	Apr. 25	16	Fort Washington Station		100,000	90,000	78,000	B 5	Apr. 29	8	May 4	11	62	58	59.8	
8	Apr. 24	20 30	Apr. 25	16	do		45,000	40,000	39,000	B 6	Apr. 29	8	May 4	9	62	58	59.8	
9			Apr. 27	16	do		125,000	105,000	100,000	B 4	Apr. 30	8	May 5	10	62	58	29.7	
10			Apr. 27	16	do		115,000	105,000	100,000	B 7	Apr. 30	8	May 6	6	62	59	59.8	
11			Apr. 27	16	do		85,000	80,000	66,000	B 31	Apr. 30	8	May 6	7	62	59	59.8	
12	Apr. 26	18	Apr. 27	16	Fort Washington seine	62°	75,000	70,000	70,000	B 30	May 1	15	May 7	6	62	59	59.8	10 12
13	Apr. 26	21 30	Apr. 27	16	do	62°	130,000	115,000	105,000	B 29	May 2	6	May 5	10	62	59	59.8	8 12½
14	Apr. 26	19 30	Apr. 27	16	do	62°	195,000	75,000	75,004	B 28	May 2	6	May 7	10	62	59	59.8	10 14½
15	Apr. 27	22 30	Apr. 28	15 30	do	61°	9,000	8,000	6,000	B 10	May 2	10	May 5	10	62	59	59.8	7 11½
16	Apr. 27	19 30	Apr. 28	15 30	do	61°	95,000	80,000	72,000	B 11	May 3	8	May 7	6	62	59	59.8	9 10½
17			Apr. 28	15 30	Fort Washington Station		100,000	98,000	96,000	B 12	May 3	8	May 6	21	62	59	59.8	
18			Apr. 29	16 15	do		90,000	45,000	45,000	B 1	May 3	21	May 7	15 30	60	59	59.5	
19			Apr. 29	16 15	do		110,000	75,000	55,000	B 2	May 4	21	May 8	9	60	59	59.5	
20			Apr. 29	16 15	do		127,000	90,000	60,000	B 3	May 5	8	May 7	15 30	60	59	59.5	
21			Apr. 30	16 15	do	62.5°	120,000	None.										
22	Apr. 30	3	May 1	16	Fort Washington seine	62°	28,000	25,000	21,000	B 4	May 6	6	May 9	4	62	59	59.7	9 1
23	Apr. 29	23 40	May 1	16	do	62°	84,000	75,000	75,000	B 5	May 5	13	May 9	6	62	59	59.7	9 6
24	Apr. 29	22 20	May 1	16	do	62°	95,000	90,000	78,000	B 6	May 5	11 30	May 9	6	62	59	59.7	9 7
25			May 1	16	Fort Washington Station		28,000	25,000	25,000	B 7	May 6	10	May 9	4	62	59	59.7	
26			May 2	16	do		100,000	92,000	78,000	B 31	May 7	15	May 9	4	62	59	59.7	
27			May 3	16	do		705,000	95,000	85,000	B 30	May 8	6	May 11	8	62	59	60.5	
28			May 3	16	do		95,000	92,000	88,000	B 29	May 8	6	May 11	13	62	59	60.5	
29			May 3	16	do		112,000	85,000	80,000	B 28	May 8	4	May 10	14	62	59	60.5	
30			May 3	16	do		112,000	68,000	64,000	B 27	May 8	4	May 10	13	62	59	60.5	
31			May 3	16	do		77,000	70,000	60,000	B 26	May 8	6	May 9	4	62	59	60	
32	May 1	15	May 3	16	Fort Washington seine	61°	52,500	50,000	50,000	B 17	May 7	21	May 10	20	62	59	60.5	9 5
33	May 2	16 30	May 3	16	do	61°	56,000	40,000	40,000	B 18	May 8	8	May 11	11	62	59	60.5	8 18½
34			May 4	16	Fort Washington Station		119,000	115,000	100,000	B 19	May 8	5	May 11	10	62	59	60	
35			May 4	16	do		115,000	105,000	100,000	B 20	May 8	6	May 10	14	62	59	60	
36			May 4	16	do		117,000	110,000	100,000	B 21			May 10	21	62	59	60	

37			May 4	16	do		77,000	70,000	70,000	B	22	May 8	4	May 10	14	62	59	60			
38			May 5	16	do		126,000	115,000	100,000	B	1	May 8	9	May 12	6	62	60	61.3			
39			May 5	16	do		113,000	105,000	100,000	B	2	May 8	9	May 12	13	62	60	61.3			
40			May 5	16	do		119,000	112,000	110,000	B	3	May 8	9	May 12	7	62	60	61.3			
41	May 3	16 30	May 5	16	Fort Washington seine	61°	79,000	77,000	77,000	B	16	May 8	9	May 12	11	62	60	61.3	8	18½	
42	May 3	16 30	May 5	16	do	61°	84,000	83,000	75,000	B	15	May 8	9	May 11	17	62	60	61.3	8	14	
43			May 6	16	Fort Washington Station		120,000	91,000	80,000	B	4	May 9	17	May 13	8	62	60	61.6			
44			May 6	16	do		116,000	107,000	92,000	B	5	May 9	15	May 13	13	62	60	61.6			
45			May 6	16	do		120,000	84,000	60,000	B	6	May 9	19	May 13	6	62	60	61.6			
46			May 6	16	do		114,000	100,000	80,000	B	7	May 9	15	May 13	7	62	60	61.6			
47			May 6	16	do		92,000	90,000	80,000	B	10	May 9	19	May 13	8	62	60	61.6			
48			May 6	16	do		63,000	57,000	57,000	B	11	May 9	21	May 12	7	62	60	61.6			
*49			May 6	16	Fort Washington seine	62°	62,000	58,000	43,000	B	12	May 9	15	May 12	7	62	60	61.6			
50			May 6	16	do	62°	103,000	98,000	95,000	B	13	May 9	15	May 13	13	62	60	61.6			
51			May 7	16	Fort Washington Station		120,000	60,000	50,000	C	11	May 11	7	May 14	8	62	61	62–			
52			May 7	16	do		128,000	95,000	85,000	C	12	May 11	9	May 15	7	62	61	62–			
53			May 7	16	do		112,000	70,000	55,000	C	13	May 11	10	May 15	6	62	61	62–			
54			May 7	16	do		105,000	70,000	56,000	C	14	May 11	10	May 15	13	62	61	62–			
55			May 7	16	do		118,000	None.													
56			May 7	16	do		124,000	None.													
57			May 7	16	do		111,000	70,000	60,000	C	19	May 11	10	May 15	5	62	61	62–			
58			May 7	16	do		118,000	80,000	70,000	C	20	May 11	10	May 15	7	62	61	62–			
59			May 7	16	do		125,000	84,000	68,000	C	21	May 11	10	May 15	5	62	61	62–			
60			May 7	20	do		110,000	80,000	77,000	F	6	May 11	14	May 15	13	63	61	62			
61			May 7	20	do		125,000	110,000	75,000	F	5			May 15	15	63	61	62			
62			May 7	20	do		95,000	85,000	78,000	F	4	May 11	8	May 15	7	62	61	62–			
63			May 7	20	do		112,000	100,000	80,000	F	3	May 10	10	May 15	6	62	61	62–			
64			May 7	20	do		100,000	95,000	87,000	F	2	May 10	10	May 15	5	62	61	62–			
65			May 7	20	do		100,000	85,000	75,000	F	1	May 11	8	May 14	15	62	61	62–			
66			May 7	20	do		105,000	90,000	77,000	F	32	May 11	8	May 14	5	62	61	62–			
67			May 7	20	do		105,000	75,000	75,000	F	31	May 11	8	May 14	8	62	61	62–			
68			May 7	20	do		100,000	90,000	80,000	F	30	May 10	11	May 15	13	63	61	62			
69			May 7	20	do		110,000	95,000	70,000	F	29	May 10	15	May 14	15	63	61	62			
70			May 7	20	do		125,000	110,000	90,000	F	28	May 10	10	May 14	6	62	61	62–			
71			May 7	20	do		105,000	75,000	70,000	F	27	May 11	7	May 15	5	62	61	62–			
72			May 7	20	do		90,000	50,000	49,000	F	26			May 14	15	62	61	62–			
73	May 6	20	May 7	20	Fort Washington seine	63°	77,000	60,000	55,000	F	24	May 12	17	May 15	15	63	61	62	8	19	
74	May 6	20	May 7	20	do	63°	55,000	45,000	45,000	F	23	May 11	8	May 15	6	62	61	62–	8	10	
75	May 6	18 30	May 7	20	do	63°	125,000	95,000	60,000	F	22	May 11	8	May 14	10	62	61	62–	7	15½	
76	May 5	18 30	May 7	20	do	62°	75,000	75,000	57,000	F	21	May 12	7	May 14	11	62	61	62–	8	16½	
77	May 6	18 30	May 7	20	do	63°	90,000	60,000	60,000	F	20	May 12	15	May 15	13	63	61	62	8	18½	
78			May 8	16	Fort Washington Station		85,000	75,000	75,000	B	16	May 12	7	May 15	13	63	61	62			
79			May 9	16	do		112,000	98,000	92,000	B	31	May 12	11	May 17	6	66	62	62.6			
80			May 9	16	do		125,000	112,000	100,000	B	30	May 12	11	May 16	7	64	62	62.5			
81			May 10	15 30	Fort Washington seine		100,000	70,000	65,000	B	1	May 13	10	May 18	5	66	62	63.1			
82			May 10	15 30	do		115,000	85,000	80,000	B	2	May 13	9	May 18	6	66	62	63.1			
83			May 10	15 30	do		120,000	120,000	100,000	B	3	May 13	6	May 18	4 30	66	62	63.1			
84			May 10	15 30	do		115,000	100,000	95,000	B	4	May 13	6	May 18	6	66	62	63.1			
85			May 10	15 30	do		125,000	110,000	95,000	B	5	May 13	10	May 17	7	66	62	63			
86			May 10	15 30	Fort Washington Station		100,000	75,000	73,000	B	6	May 13	10	May 17	14	66	62	63			

*See crate card.

TABLE V.—*Daily register of eggs received and fish hatched at Central Station, U. S. Fish Commission, season of* 1885—Continued.

No. of record card.	Eggs taken.		Eggs received.		Whence obtained.	Temperature of water used in impregnating the eggs.	Total number received.	Number received alive	Number of fish produced.	Disposal of eggs while hatching.	Period of hatching.				Temperature during incubation.			Days and hours in incubating.
											Began.		Ended.					
	Date.	Hour of day.	Date.	Hour of day.							Date.	Hour of day.	Date.	Hour of day.	Max.	Min.	Av.	
		h. m.		*h. m.*								*h. m.*		*h. m.*				*d. h.*
87			May 10	15 30	Fort Washington Station		120,000	80,000	80,000	B 7	May 13	10	May 18	5	66	62	63.1	
88			May 10	15 30	do		125,000	80,000	70,000	B 10	May 13	10	May 17	14	66	62	63	
89			May 10	15 30	do		105,000	80,000	65,000	B 11	May 13	10	May 16	7	64	62	62+	
90			May 10	15 30	do		105,000	98,000	95,000	B 12	May 13	6	May 16	7	64	62	62+	
91			May 10	15 30	do		112,000	95,000	80,000	B 13	May 12	15	May 16	20	66	62	63	
92			May 10	15 30	do		119,000	100,000	65,000	B 14	May 13	10	May 17	9	66	62	63	
93			May 10	15 30	do		125,000	85,000	78,000	B 15			May 16	8	64	62	62+	
94			May 10	15 30	do		120,000	120,000	105,000	B 29	May 13	10	May 17	9	66	62	63	
95			May 10	15 30	do		115,000	110,000	85,000	B 28	May 13	6	May 15	13	63	62	62+	
96			May 10	15 30	do		98,000	90,000	80,000	B 27	May 13	6	May 16	16	64	62	63	
97			May 10	15 30	do		91,000	75,000	70,000	B 26	May 13	6	May 17	17	66	62	63.1	
98	May 10		May 11	16	Fort Washington seine		120,000	110,000	105,000	B 17*								
99	May 10		May 11	16	do		97,000	77,000	68,000	B 18*								
100	May 10		May 11	16	do		112,000	90,000	75,000	B 19	May 15	6	May 18	9	66	62	63.1	
101			May 11	16	Fort Washington Station		112,000	90,000	80,000	B 20	May 15	13	May 18	8	66	62	63.1	
102			May 11	16	do		110,000	78,000	77,000	B 21*								
103			May 11	16	do		110,000	82,000	72,000	B 22	May 15	13	May 18	13	66	62	63.3	
104			May 11	16	do		130,000	100,000	70,000	C 17	May 15	8	May 18	6	66	62	63.3	
105			May 11	16	do		120,000	90,000	75,000	C 18	May 15	8	May 18	7	66	62	63.3	
106			May 11	16	do		125,000	100,000	80,000	C 19	May 15	8	May 18	8	66	62	63.3	
107	May 11	18 30	May 12	16	Fort Washington seine	62°	105,000	98,000	85,000	B 30	May 16	7	May 18	20	67	62	63.6	7 13
108	May 11	18 30	May 12	16	do	62°	105,000	92,000	85,000	B 31	May 15	7	May 18	19	67	62	63.6	7 9
109	May 11	18 30	May 12	16	do	62°	112,000	98,000	80,000	B 16	May 16	7	May 18	18	67	62	63.6	6 23
110	May 11	18 30	May 12	16	do	62°	70,000	60,000	50,000	C 20	May 16	7	May 19	8	68	62	63.7+	7 13
111	May 11	21 30	May 12	16	do	62°	130,000	103,000	80,000	C 16	May 16	7	May 19	9	68	62	63.7+	7 11
112			May 12	16	Fort Washington Station		117,000	70,000	55,000	C 15	May 16	7	May 18	20	67	62	63.6	
113			May 12	16	do		112,000	78,000	60,000	C 14	May 16	7	May 18	8	66	62	63.6	
114			May 12	16	do		118,000	30,000	22,000	C 13	May 16	7	May 18	20	67	62	63.6	
115			May 12	16	do		115,000	70,000	68,000	C 12	May 16	7	May 18	20	67	62	63.6	
116			May 12	16	do		120,000	85,000	45,000	D 17	May 16	7	May 18	20	67	62	63.6	
117			May 12	16	do		115,000	85,000	60,000	D 18	May 16	7	May 18	19	67	62	63.6	
118			May 12	16	do		122,000	95,000	60,000	D 19	May 16	7	May 18	19	67	62	63.6	
119			May 12	16	do		100,000	80,000	80,000	D 16	May 16	7	May 19	8	68	62	63.6+	
120			May 12	16	do		60,000	42,000	35,000	D 15	May 16	7	May 19	8	68	62	63.6	
121			May 13	16	Fort Washington seine	62°	112,000	95,000	80,000	E 1	May 17	13	May 20	9	68	62	65	
122			May 13	16	do	62°	95,000	70,000	50,000	B 2	May 17	13	May 20	14	68	62	65	

123			May 13	16	Fort Washington Station		115,000	92,000	60,000	B	3	May 17	13	May 20	14	68	62	65			
124			May 13	16	do		100,000	85,000	65,000	B	4	May 17	11	May 20	9	68	62	65			
125			May 13	16	do		98,000	80,000	65,000	B	5	May 17	11	May 20	10	68	62	65			
126			May 13	16	do		95,000	78,000	60,000	B	6	May 17	11	May 20	12	68	62	65			
127			May 13	16	do		77,000	50,000	40,000	B	7	May 17	11	May 19	21	68	62	65			
128	May 13	20	May 14	16	Fort Washington seine	61.5°	98,000	80,000	70,000	B	29	May 18	14	May 20	15	68	62	65	6	19	
129	May 13	20	May 14	16	do	61.5°	63,000	58,000	55,000	B	28	May 18	10	May 19	21	68	62	65	6	1	
130			May 14	16	Fort Washington Station		77,000	60,000	40,000	B	27	May 18	14	May 20	9	68	62	65			
131			May 14	16	do		91,000	42,000	30,000	B	26	May 18	14	May 20	9	68	62	65			
132			May 14	16	do		98,000	72,000	55,000	B	18	May 18	13	May 20	15	68	62	65			
133			May 14	16	do		119,000	90,000	50,000	B	21	May 18	14	May 20	9	68	62	65			
134			May 14	16	do		77,000	50,000	30,000	B	18	May 18	13	May 20	9	68	62	65			
135			May 14	16	do		56,000	40,000	20,000	B	17	May 18	13	May 20	9	68	62	65			
135a	May 14	20 30	May 15	16	Fort Washington seine	62°	65,000	None.													
136			May 15	16	Fort Washington Station		125,000	100,000	85,000	B	19	May 19	9	May 21	9	68	62	66.5			
137			May 15	16	do		120,000	80,000	80,000	B	20	May 19	9	May 21	8	68	62	66.5			
138			May 15	16	do		105,000	55,000	55,000	B	21	May 19	8	May 20	16	68	62	66.5			
139	May 15	14	May 16	16	Fort Washington seine	63°	40,000	35,000	25,000	E	2	May 19	13	May 21	17	68	65	67	6	3	
140			May 16	16	Fort Washington Station		65,000	55,000	52,000	E	5	May 19	14	May 22	14	70	65	67+			
141			May 16	16	do		110,000	85,000	80,000	E	32	May 19	13	May 22	15	70	65	67+			
142			May 16	16	do		90,000	68,000	60,000	E	28	May 19	14	May 22	11	70	65	67+			
143			May 16	16	do		110,000	80,000	75,000	E	27	May 19	15	May 22	11	70	65	67+			
144			May 16	16	do		120,000	90,000	75,000	E	26	May 19	13	May 21	16	68	65	67+			
145			May 18	16	Fort Washington seine		100,000	85,000	78,000	E	17	May 19	17	May 22	18	70	66	68			
146			May 18	16	do		105,000	90,000	82,000	E	18	May 19	18	May 23	17	70	66	68			
147			May 18	16	do		95,000	78,000	78,000	E	19	May 19	18	May 23	12	70	66	68			
148			May 18	16	Fort Washington Station		110,000	75,000	65,000	E	20	May 20	14	May 22	6	70	66	68			
149			May 18	16	do		112,000	55,000	50,000	E	21	May 20	14	May 23	4	70	66	68			
150			May 18	16	do		112,000	45,000	45,000	E	16	May 20	14	May 23	4	70	66	68			
151			May 18	16	do		100,000	80,000	72,000	E	15	May 19	17	May 23	4	70	66	68			
152			May 18	16	do		105,000	90,000	85,000	E	14	May 19	20	May 23	11	70	66	68			
153			May 19	16	Fort Washington seine		100,000	83,000	80,000	E	10	May 21	12	May 24	15	70	68	69			
154			May 19	16	do		28,000	28,000	25,000	E	9	May 21	12	May 24	7	70	68	69			
155			May 19	16	Fort Washington Station		112,000	90,000	85,000	E	13	May 21	12	May 24	6	70	68	69			
156			May 19	16	do		112,000	60,000	60,000	E	12	May 21	12	May 24	6	70	68	69			
157			May 19	16	do		100,000	60,000	57,000	E	11	May 21	12	May 24	8	70	68	69			
158	May 19	18	May 21	16	Fort Washington seine	70°	100,000	90,000	90,000	E	17	May 22	8	May 25	15	71	68	69.5	5	21	
159	May 19	18	May 21	16	do	70°	50,000	48,000	48,000	E	18	May 22	8	May 25	8	71	68	69.5	5	14	
160			May 21	16	Fort Washington Station		115,000	75,000	75,000	E	19	May 22	8	May 25	11	71	68	69.5			
161			May 21	16	do		105,000	60,000	60,000	E	20	May 22	8	May 25	8	71	68	69.5			
162			May 21	16	do		120,000	75,000	75,000	E	21	May 22	8	May 24	10	71	68	69.5			
163	May 20	18 30	May 22	16	Fort Washington seine	70°	78,000	77,000	77,000	E	17	May 23	8	May 26	5	71	70	70.5	5	½	
164	May 20	18 30	May 22	16	do	70°	95,000	92,000	92,000	E	18	May 23	8	May 26	5	71	70	70.5	4	23½	
165			May 22	16	Fort Washington Station		98,000	95,000	95,000	E	19	May 23	8	May 26	8	71	70	70.5			
166			May 22	16	do		105,000	102,000	102,000	E	20	May 23	8	May 26	8	71	70	70.5			
167			May 23	16	Fort Washington seine		45,000	44,000	44,000	E	23	May 25	17	May 27	16 30	71	70	70.5			
168	May 21	18 30	May 23	16	do	70°	35,000	35,000	30,000	E	22	May 24	16	May 27	6	71	70	70.5	5	11½	
169	May 21	17	May 23	16	do	70°	77,000	77,000	77,000	E	21	May 24	16	May 27	7	71	70	70.5	5	14	
170	May 22	18 30	May 23	16	do	69°	78,000	75,000	72,000	E	20	May 24	16	May 27	15	71	70	70.5	4	20½	
171	May 21	20	May 23	16	do	70°	75,000	70,000	60,000	E	19	May 24	16	May 27	7	71	70	70.5	5	11	

*Shipped (as eggs) to Fred Mather, N. Y., 7 p. m. May 13, 1885.

TABLE V.—*Daily register of eggs received and fish hatched at Central Station, U. S. Fish Commission, season of* 1885—Continued.

No. of record card.	Eggs taken.		Eggs received.		Whence obtained.	Temperature of water used in impregnating the eggs.	Total number received.	Number received alive.	Number of fish produced.	Disposal of eggs while hatching.	Period of hatching.				Temperature during incubation.			Days and hours in incubating.
											Began.		Ended.					
	Date.	Hour of day.	Date.	Hour of day.							Date.	Hour of day.	Date.	Hour of day.	Max.	Min.	Av.	
		h. m.		*h. m.*								*h. m.*		*h. m.*				*d. h.*
172	May 21	18 50	May 23	16	Fort Washington seine	70°	72,000	72,000	69,000	E 18	May 24	16	May 27	6	71	70	70 5	5 11½
173	May 21	17	May 23	16	....do	70°	35,000	35,000	33,000	E 17	May 24	16	May 27	7	71	70	70.5	5 14
174	May 22	17	May 23	16	....do	70°	50,000	48,000	45,000	E 16	May 25	17	May 28	6	71	70	70.5	5 13
175	May 22	19 30	May 23	16	....do	70°	60,000	57,000	56,000	E 15	May 25	17	May 28	5	71	70	70.5	5 9½
176	May 22	18 30	May 23	16	....do	69°	35,000	35,000	35,000	E 14	May 25	17	May 28	5	71	70	70.5	4 22
177	May 22	19 30	May 23	16	....do	70°	85,000	77,000	75,000	E 13	May 25	12	May 28	5	71	70	70.5	5 9½
178	.....	.....	May 23	16	Fort Washington Station	.....	100,000	97,000	96,000	E 12	May 24	16	May 27	15	71	70	70.5	.....
179	.....	.....	May 23	16	....do	.....	45,000	45,000	45,000	E 11	May 24	16	May 27	14	71	70	70.5	.....
180	.....	.....	May 23	16	....do	.....	105,000	75,000	66,000	E 10	May 25	10	May 27	15	71	70	70.5	.....
181	.....	.....	May 23	16	....do	.....	60,000	55,000	55,000	E 9	May 24	16	May 27	9	71	70	70.5	.....
182	May 23	21 30	May 25	16	Fort Washington seine	70°	85,000	75,000	75,000	E 17	May 26	14	May 28	20	71	70	70.5	4 22½
183	May 23	20	May 25	16	....do	70°	90,000	84,000	84,000	E 18	May 26	14	May 28	20	71	70	70.5	5
184	May 23	18 30	May 25	16	....do	70°	35,000	28,000	28,000	E 19	May 26	14	May 29	6	71	69	70	5 11½
185	.....	.....	May 25	16	Fort Washington Station	.....	112,000	100,000	100,000	E 20	May 26	14	May 28	19	71	70	70.5	.....
186	.....	.....	May 25	16	....do	.....	78,000	75,000	75,000	E 21	May 26	14	May 28	21	71	70	70.5	.....
187	May 24	21	May 26	16	Fort Washington seine	70°	70,000	70,000	70,000	E 16	May 27	16	May 30	21	70	69	70—	6
188	May 24	21	May 26	16	....do	70°	70,000	70,000	70,000	E 15	May 27	17	May 30	10	70	69	70—	5 13
189	.....	.....	May 26	16	Fort Washington Station	.....	72,000	72,000	72,000	E 14	May 27	20	May 30	8	70	69	70—	.....
190	.....	.....	May 26	16	....do	.....	85,000	85,000	85,000	E 13	May 27	20	May 30	10	70	69	70—	.....
191	.....	.....	May 26	16	....do	.....	98,800	86,000	86,000	E 12	May 27	21	May 30	5	70	69	70—	.....
192	May 25	20 45	May 27	16	Fort Washington seine	67°	84,000	77,000	77,000	E 17	May 28	14 30	May 31	10	70	69	69.5	5 13½
193	May 25	20 45	May 27	16	....do	67°	90,000	84,000	84,000	E 18	May 28	14 30	May 31	9	70	69	69.5	5 12½
194	May 25	22	May 27	16	....do	67°	70,000	62,000	62,000	E 19	May 28	14 30	May 31	6	70	69	69.5	5 8
195	May 25	23 30	May 27	16	....do	67°	30,000	22,000	22,000	E 20	May 28	14 30	May 30	20	70	69	69.5	4 20½
196	.....	.....	May 27	16	Fort Washington Station	.....	100,000	90,000	90,000	E 21	May 28	14 30	May 31	6	70	69	69.5	.....
197	.....	.....	May 27	16	....do	.....	112,000	100,000	100,000	E 22	May 28	13	May 30	21	70	69	69 5	.....
198	.....	.....	May 27	16	....do	.....	80,000	77,000	77,000	E 23	May 28	14 30	May 31	7	70	69	69.5	.....
199	.....	.....	May 27	16	....do	.....	80,000	76,000	76,000	E 24	May 28	14 30	May 30	21	70	69	69.5	.....
200	May 26	20	May 28	16	Fort Washington seine	69°	112,000	95,000	90,000	E 16	May 30	9	June 1	10	70	69	69.5	5 14
201	May 27	20 40	May 28	16	....do	71°	85,000	75,000	75,000	E 15	May 30	21	June 2	12	70	69	69.5	5 15½
202	May 26	20 30	May 28	16	....do	69°	42,000	40,000	40,000	E 14	May 30	21	June 1	11	70	69	69.5	5 14½
203	May 26	20 30	May 28	16	....do	69°	63,000	60,000	60,000	E 13	May 30	21	June 1	21	70	69	69.5	6 0½
204	May 26	.....	May 28	16	Fort Washington (Moxley's Point) Station.	.....	77,000	77,000	77,000	E 12	May 30	21	June 1	17	70	69	69.5	.....
205	.....	.....	May 28	16	Fort Washington Station	.....	95,000	82,000	77,000	E 11	May 30	9	June 1	6	70	69	69.5	.....
206	.....	.....	May 28	16	....do	.....	110,000	95,000	85,000	E 10	May 30	9	June 1	13	70	69	69.5	.....

207	.....	.....	May 28	16	.....do.....	.....	77,000	70,000	70,000	E 9	May 30	9	June 2	17	70	69	69.5	.....
208	.....	.....	May 28	16	.....do.....	.....	110,000	75,000	70,000	E 7	May 30	9	June 1	13	70	69	69.5	.....
209	.....	.....	May 29	16	Fort Washington seine.....	.....	49,000	None.										.....
210	May 28	22	May 29	16	.....do.....	70°	105,000	85,000	85,000	E 18	May 31	23	June 3	20	71	69	70	5 22
211	May 28	21 15	May 29	16	.....do.....	70°	98,000	75,000	75,000	E 19	May 31	14	June 3	7	71	69	70	5 9¾
212	.....	.....	May 29	16	Fort Washington Station.....	.....	110,000	70,000	70,000	E 20	May 31	14	June 3	7	71	69	70	.....
213	.....	.....	May 29	16	.....do.....	.....	130,000	90,000	90,000	E 21	May 31	14	June 3	18	71	69	70	.....
214	May 29	21 40	May 30	16	Fort Washington seine.....	71°	91,000	68,000	68,000	G 22	June 2	11	June 5	4	72	69	70.5	6 6⅜
215	May 29	19 40	May 30	16	.....do.....	71°	72,000	50,000	45,000	G 23	June 2	12	June 4	21	72	69	70.5	6 1⅝
216	May 29	23	May 30	16	.....do.....	70°	85,000	75,000		G 25†								.....
217	May 29	23	May 30	16	.....do.....	70°	72,000	42,000	42,000	G 26	June 2	13	June 4	14	72	69	70.5	5 15
218	.....	.....	May 30	16	Fort Washington Station.....	.....	85,000	70,000	60,000	G 11	June 2	11	June 4	11	72	69	70.5	.....
219	.....	.....	May 30	16	.....do.....	.....	72,000	54,000	50,000	G 10	June 2	12	June 4	11	72	69	70.5	.....
220	.....	.....	May 30	16	..... do.....	.....	75,000	52,000	50,000	G 7	June 2	12	June 4	7	71	69	70	.....
221	.....	.....	May 31	15	.....do.....	.....	95,000	50,000	50,000	G 16	June 4	6	June 5	13	72	69	70.5	.....
222	.....	.....	May 31	15	.....do.....	.....	50,000	30,000	30,000	G 15	June 4	6	June 5	6	72	69	70.5	.....
223	May 31	30	May 31	15	Fort Washington seine.....	72°	65,000	None.										.....
224	.....	.....	June 3	16	Fort Washington Station.....	.....	35,000	34,000	34,000	G 14	June 6	6	June 7	6	73	71	72	.....
225	.....	.....	June 6	16	.....do.....	.....	42,000	40,000	40,000	G 14	June 8	8	June 10	5	73	71	72	.....

*Eggs of one female shad.

†To J. F. Ellis, for hatching on car No. 3.

TABLE VI.—*Statement of young shad planted in waters of the United States, season of 1885.*

Date.	Stream stocked.	Place of deposit.	Number of fish shipped.	Number died on the way.	Number planted.	Product of.	Messenger in charge of shipment.
May 4	Monocacy River	Frederick Junction, Md	300,000	(*)	300,000	Central Station	F. L. Donnelly.
4	Chester River	Chestertown, Md	250,000	(*)	250,000	Battery Station	Do.
6	Susquehanna River	Harrisburg, Pa	300,000	(*)	300,000	do	Do.
9	Shenandoah River	Luray, Va	199,000	2,000	197,000	Central Station	W. A. Dunnington.
10	Palmer River	Eight miles from Providence, R. I	1,850,000	25,000	825,000	do	N. Simmons.
14	Congaree River	Columbia, S. C	1,050,000	525,000	525,000	do	G. H. H. Moore.
15	Shenandoah River	Waynesborough, Va	1,000,000	(*)	1,000,000	do	Do.
15	Conecuh River	Troy, Ala	200,000	(*)	200,000	do	F. L. Donnelly.
15	Murder Creek	Evergreen, Ala	100,000	(*)	100,000	do	M. N. Tune.
15	Sepulga River	do	100,000	(*)	100,000	do	Do.
15	Mattaponv River	Milford Station, Va	344,000	(*)	344,000	do	C. A. Stewart.
16	Carp ponds	Washington, D. C	100,000	(†)	100,000	do	J. Mace.
16	Occoquan River	Wood Bridge Station, Va	347,000	(*)	347,000	do	C. A. Stewart.
16	Alabama River	Montgomery, Ala	774,000	(*)	774,000	Battery and Central Stations	N. Simmons.
17	Broad Run	Near Bristoe Station, Va	375,000	(*)	375,000	Central Station	C. A. Stewart.
18	Accotink Creek	Long Branch Station, Va	175,000	(*)	175,000	do	Do.
20	Acquia Creek	Richland Station, Va	200,000	(*)	200,000	do	Do.
20	Potomac Creek	Near Brooks Station, Va	220,000	(*)	220,000	do	Do.
21	Ochlockonee River	Intersection Savannah, Florida and Western Railroad, Georgia.	300,000	18,000	282,000	do	N. Simmons.
21	Aucilla River	do	300,000	18,000	282,000	do	Do
21	Withlacoochee River	do	300,000	18,000	282,000	do	Do.
21	Allapaha River	do	350,000	21,000	329,000	do	Do.
21	Rivanna River	Charlottesville, Va	220,000	(*)	220,000	do	C. A. Stewart.
21	Rappahannock River	Rappahannock, Va	350,000	(*)	350,000	do	J. E. Brown.
22	Rapidan River	Rapidan Station, Va	189,000	(*)	189,000	do	C. A. Stewart.
22	Hudson River	Mechanicsville, N. Y	1,250,000	(*)	1,250,000	Battery Station	J. F. Ellis.
23	Appomattox River	Mattoax Station, Va	185,000	18,000	167,000	Central Station	C. A. Stewart.
23	Chickahominy River	Near Hunslet, Va	187,000	5,000	182,000	do	J. E. Brown.
24	Colorado River	The Needles, Ariz	998,000	150,000	848,000	do	G. H. H. Moore.
24	Rappahannock River	Fredericksburgh, Va	370,000	(*)	370,000	do	J. E. Brown.
25	Dan River	Danville, Va	1,500,000	(*)	1,500,000	Battery Station	J. F. Ellis.
27	Green River	Near Landrum, S. C	1,000,000	50,000	950,000	Central Station	N. Simmons.
27	North East River	North East, Md	250,000	(*)	250,000	Battery Station	F. L. Donnelly.
28	Rivanna River	Charlottesville, Va	187,000	(*)	187,000	Central Station	C. A. Stewart.
28	Gunpowder River	Gunpowder, Md	250,000	(*)	250,000	Battery Station	F. L. Donnelly.
28	North Anna River	Chesapeake and Ohio Junction, Va	175,000	(*)	175,000	Central Station	C. A. Stewart.
28	Little River	Near Taylorsville, Va	175,000	(*)	175,000	do	J. E Brown.
30	Patapsco River	Relay House, Md	200,000	(*)	200,000	Battery Station	F. L. Donnelly.
June 1	Elk River	Elkton, Md	250,000	(*)	250,000	do	Do.
2	Fox River	Aurora, Ill	500,000	40,000	460,000	Central Station	N. Simmons.
3	Illinois River	Peoria, Ill	700,000	56,000	644,000	do	Do.

5	Bush River	Bush Station, Md	250,000	(*)	250,000	Battery Station	F. L. Donnelly.
7	Susquehanna River	Sunbury, Pa	500,000	(*)	500,000	do	Do.
8	Blue River	Manhattan, Kans	345,000	24,000	321,000	Central Station	N. Simmons.
8	Republican River	Junction City, Kans	247,000	17,000	230,000	do	Do.
8	Smoky River	do	345,000	24,000	321,000	do	Do.
10	Snake River	Ainsworth, Wash	10,000	(*)	10,000	do	G. H. H. Moore.
11	Willamette River	East Portland, Oreg	900,000	850,000	50,000	do	Do.
13	Carp ponds	Washington, D. C	74,000	(†)	74,000	do	J. Mace.
May 10 to June 13	Piscataway River	Fort Washington Station	1,000,000		1,000,000		
	Total		20,732,000		18,871,000		

* Too small to estimate. † None.

The results of the work of shad production conducted on the Potomac River and at Central Station during the season of 1885 under my immediate direction are as follows:

Number retained at Fort Washington Station	1,557,000
Number forwarded to Central Station	21,019,000
Total number of shad eggs collected on the Potomac River, season of 1885	22,576,000
The number of eggs received at Central Station in good condition was	16,536,000
Number of eggs shipped to other points	325,000
Number of eggs hatched at Central Station	16,211,000
Number of shad fry planted in the Potomac River at Fort Washington Station	1,000,000
Number hatched and distributed from Central Station	14,531,000
Total product for distribution from Potomac River stations	15,531,000

The average loss from impregnation to the period of hatching was 31 per cent.

The average loss during incubation at Central Station was 10 per cent.

The cost of production was, in round numbers, at the rate of $330 for each million shad fry furnished for distribution, or more than thirty young shad for each cent of expenditures made. The above table VI includes the entire distribution made under my direction by car and messenger service. It does not include the local plants made in the Delaware by the commission steamer Fish Hawk, nor those made in the Susquehanna near Battery Station.

131.—REPORT OF SHAD HATCHING OPERATIONS BY THE STEAMER LOOKOUT, SEASON OF 1885.

By JAMES A. SMITH,

Mate, U. S. N., Commanding.

I respectfully submit the following report, with appended record and meteorological tables, of the fish-hatching operations conducted on board this vessel during the past season, from May 13, to June 5, 1885, inclusive. On the return from the trip to Florida, arriving at Washington, D. C., May 8, took on board all the hatching equipment, consisting of 2 cone stands, 8 cones, and 24 McDonald hatching jars, and proceeded at 1 p. m. on the 9th to Baltimore, Md. Arrived there on the 10th at 8 a. m. and made fast to Clark's machine-shop wharf, to have some needed repairs made to the boiler. By Wednesday, May 13, repairs to the boiler being completed, received orders from Assistant Commissioner T. B. Ferguson to proceed to Battery Station, Havre de Grace, Md., and begin operations in shad hatching in that vicinity. Left Baltimore, Md., at 6.50 a. m., and arrived at Battery Station at 11.40 a. m. Crew employed fitting up hatching cones and jars. As the crew of the vessel was not experienced in spawn-taking, two expert spawn-takers were detailed from the station for duty, and two of the crew were sent on shore in their places, to be instructed in spawn-taking. At 3.30 p. m. left Battery Station, steamed over to North East River and visited Carpenter's Point and Red Bank fisheries, also the gill-boat men, and made arrangements about getting spawn; at 6.15 p. m. anchored off Bull Mountain. At 7 p. m. sent spawn takers to tend gill-boats; at 10 p. m. spawn-takers returned with 217,000 shad eggs. Placed them in the McDonald jars.

Thursday, May 14.—At 6.30 a. m. we got under way and steamed over to Battery Station; at 3.30 p. m. returned to North East River, east side of the bay, and left spawn-takers at Carpenter's Point and Red Bank fisheries; at 6 came to anchor off Bull Mountain. During the evening the spawn-takers tended as many gill-boats as possible, and succeeded in procuring from fisheries and gill-boats 338,000 shad eggs. Put 173,000 in McDonald jars, and kept the remainder for Battery Station.

Friday, May 15.—At 6 a. m. got under way and steamed over to Battery Station, arriving at 7 a. m. Transferred 165,000 shad eggs to superintendent of Battery Station. At 3.30 p. m. left station and proceeded across the bay to North East River. Distributed spawn-takers to fisheries and gill-boats. During the evening spawn takers returned, having succeeded in procuring 529,000 shad eggs. Gillers report fair catches.

Saturday, May 16.—At 6 a. m. steamed over to Battery Station and transferred all the spawn obtained last evening, 529,000, to superintend-

ent of Battery Station. At 11.30 a. m. cast off from wharf at Battery Station and proceeded to Havre de Grace, Md. Arrived and made fast to Hille's wharf and took on board five tons of coal. At 1 p. m. Asst. Com. T. B. Ferguson came on board, and at 3 we cast off and steamed down to Battery Station with a lighter in tow. Arrived at 4 p. m. Assistant Commissioner Ferguson went on shore. At 4.20 cast off from Battery Station and steamed over to North East River. Picked up two spawn-takers, who had gone over to Carpenter's Point fishery during the day, having procured 212,000 shad eggs, and at 5.45 came to anchor off Ball Mountain. Sent spawn-takers to tend gill-boats. Furnished John C. Ford, giller and an experienced spawn-taker, with pans, &c., and was authorized by Assistant Commissioner Ferguson to pay him at the rate of $20 per 1,000,000 for all good impregnated shad eggs. At midnight spawn-takers returned, having failed to obtain any spawn. John C. Ford delivered 110,000, making 322,000 procured during the day.

Sunday, May 17.—At 5 a. m. steamed over to Battery Station and transferred 322,000 shad eggs to superintendent of Battery Station. At 7.45 a. m. Assistant Commissioner Ferguson came on board with two expert spawn-takers. Cast off from wharf; steamed up Elk River and through the Delaware and Chesapeake Canal. At noon locked out at Delaware City, and proceeded up the Delaware River. Visited Howell's fishery at Gloucester Point, New Jersey. Landed Assistant Commissioner Ferguson at Philadelphia. At 4.30 p. m. returned to Gloucester Point, New Jersey, and came to anchor to be ready to tend the hauls in the morning, and make an examination of the fishing shores between Philadelphia and Chester, for the purpose of establishing a hatching station. Shad eggs procured on the 13th from the Chesapeake began to hatch out this morning.

Monday, May 18.—At 5 a. m. sent spawn-takers to tend hauls at Rice's and Howell's fisheries. Catch of fish very large, but no ripe fish to be found. At 4 p. m. left two spawn-takers at Howell's fishery; steamed down the river and anchored near Faunce's fishing shore, and sent spawn-takers to tend the sundown hauls. At 6.30 p. m. spawn-takers returned with 878,000 shad eggs from Faunce's fishery and 268,000 from Howell's, making a total of 1,146,000. From information received from the fishermen and from our own observation I concluded that in a few days a great many ripe fish would be found. The spawning season had just commenced in this vicinity, and large numbers of shad were being captured. The assistant commissioner, to arouse interest among the fishermen, directed me to pay at the rate of $10 per 1,000,000 for good eggs, and his instructions were carried out. At sundown deposited in the river opposite Faunce's fishery 100,000 shad fry, hatched out from eggs procured on the Chesapeake. At 7.50 p. m. steamed up to Philadelphia, landed the assistant commissioner, returned to Gloucester Point, and at 11.30 and came to anchor.

Tuesday, May 19.—Spawn-takers tended all the hauls at Rice's and Howell's fisheries during the day, but found no ripe fish. At 5 p. m. steamed down the river, and came to anchor near Faunce's fishery. Spawn-takers returned from sundown hauls with 950,000 shad eggs. At sundown deposited in the river opposite Faunce's fishing-shore 75,000 shad fry, from eggs procured in Chesapeake Bay.

Wednesday, May 20.—Having received orders from Assistant Commissioner Ferguson to return to Battery Station, Havre de Grace, Md., this morning, got under way at 5 a. m. and steamed down the Delaware River. At 8 a. m. locked into Chesapeake and Delaware Canal, and at noon locked out at Chesapeake City, and proceeded down Back Creek and Elk River. At 1 p. m. deposited 75,000 shad fry in middle of Elk River opposite the mouth of Bohemia Creek; arrived at Battery Station at 2 p. m., and transferred to superintendent of Battery Station 348,000 shad eggs; eggs procured on the 13th and 14th nearly all hatched out. On account of a severe rain-storm did not go over to east side of bay; sent spawn-takers to tend gill boats near Battery Station. At 11.30 p. m. spawn-takers returned with 30,000 shad eggs; transferred them to superintendent of station.

Thursday, May 21.—At 4 p. m. left Battery Station and steamed over to North East River, and came to anchor off Bull Mountain. Sent out spawn-takers; at 11 p. m. spawn-takers returned without any eggs. Eggs received on the 18th and 19th began to hatch out in hatching-jars. Those of the same dates, which were put in the cones, do not seem to do so well, as I find very many dead ones; changing the water from the Delaware River to the Susquehanna, also passing through the canal, where one part of it is strongly impregnated with iron, may be the cause—the result of which, only about 50 per cent are hatching out. At sundown deposited 50,000 shad fry in North East River.

Friday, May 22.—At 6 a. m. steamed over to Battery Station; during the afternoon deposited in the channel opposite the station 25,000 shad fry. At 5 p. m. left Battery Station, steamed over to North East River, and anchored in the usual place. Sent out spawn-takers; at midnight they returned, but failed to get any eggs; the weather being so overcast and rainy, very few gillers were out.

Saturday, May 23.—At 6 a. m. steamed over to Battery Station. At 9 a. m. left station, took lighter in tow, and proceeded to Havre de Grace, Md., made fast to Hille's wharf, and took on board 5 tons of coal. At noon Assistant Commissioner Ferguson came on board; cast off and steamed down to Battery Station; transferred 348,000 shad eggs and 277,000 shad fry to superintendent of station. At 2 p. m. left station and proceeded to Baltimore, Md.; at 6 p. m. arrived and made fast to wharf at Chester River Steamboat Company.

Sunday, May 24.—At 11 a. m. Asst. Com. T. B. Ferguson came on board; cast off and proceeded to Battery Station; at 3.45 p. m. arrived;

at 5.45 cast off and returned to Baltimore, arriving there at 10 p. m.; made fast to same wharf.

Monday, May 25.—At 11.40 left Baltimore, Md., and returned to Battery Station, arriving there at 4 p. m. At 4.45 steamed over to North East River and anchored in the usual place, off Bull Mountain; sent out spawn-takers; spawn-takers returned at midnight with 35,000 shad eggs; fish getting very scarce; fishing shores at Carpenter's Point and Red Bank cut out, and quite a number of the gillers have stopped fishing.

Tuesday, May 26.—At 6 a. m. steamed over to Battery Station; transferred 35,000 shad eggs to superintendent of station. Owing to the stormy weather did not go over to the east side of bay; spawn-takers tended gillers in vicinity of station, but failed to get any eggs.

Wednesday, May 27.—At 8 a. m. left station and steamed up to Havre de Grace, Md., with Assistant Commissioner Ferguson, coaled ship and returned to station. Received orders from Assistant Commissioner Ferguson to proceed to the Delaware River and make an investigation of the fisheries above Philadelphia, as far as Bordentown, N. J.; spawn-taker S. J. Talbott was detailed to go with us to assist. At 11.30 left Battery Station and steamed up Elk River to canal. At 1.40 locked in at Chesapeake City. At 5 p. m. arrived at Delaware City; received telegraphic orders from Commissioner S. F. Baird to wait for launch Cygnet and force of spawn-takers; locked out of canal and came to anchor in the stream; interviewed fishermen on shore and found that very few shad were being caught in this vicinity, and what were captured were down-runners.

Thursday, May 28.—At anchor in river opposite Delaware City; at 3.30 p. m. launch Cygnet and spawn-takers arrrived; got under way; took her in tow and proceeded up the Delaware River; at sundown came to anchor off Red Bank, N. J., near to U. S. Fish Commission steamer Fish Hawk; communicated with her, and found that her force of spawn-takers could tend to all the fishing shores in the vicinity.

Friday, May 29.—At 8 a. m. steamed up the Delaware River, passing Philadelphia at 9 a. m.; arrived at Riverton, opposite Ten-mile Point, at 10 a. m. Interviewed William Faunce, who fishes a 200-fathom seine at this point, making nine hauls a day, between sunrise and sunset. The season was an average one in the yield of shad, but for the past two weeks no ripe fish had been observed. Previous to that time they had been abundant. On this day, up to the time of our interview, five hauls had been made, yielding 90 shad. Mr. Faunce informed me that he had been catching about 200 shad a day; was here informed that there were about 25 gillers who operated between Petty's Island and Riverton. About ten days previous to the visit of the Lookout these gillers had been very successful, but since that time the catch had greatly diminished. Left Riverton and pro-

ceeded up the Delaware, stopping at fishing shore on Hawk Island, near the entrance to Rancocas Creek. This shore is owned and operated by George Rice & Sons. They work a 150-fathom seine, and make thirteen hauls a day. Up to 12.30 p. m. had made six hauls, and caught 22 shad. The catch for the season had been rather small. This shore, however, is not considered a very good one, but about this locality 30 or more gillers operate; was informed that most of them had done well during the season. Attempts were made to obtain spawn from the Rice shore, as the seine was just about being landed, but with no success. At 1.30 continued up the river, passing "frog-pond" fishery on the Pennsylvania side of the river, about 1 mile below Beverly, which at this time was not in operation. The owner represented that he had made a very successful season before stopping operations; very few gillers operate here. At 2.30 arrived at Badger's Island fishery, on Badger's Island, half a mile below Burlington, N. J. This shore is owned and fished by Captain Dwyer; works a 200-fathom seine, averaging ten hauls a day. Herring very plentiful, but shad scarce at this fishery. At 2.30 seven hauls had been made and 40 shad captured; no spawn obtained. Continued up river, and at 3.30 arrived at Hayes's fishing shore, half a mile above Burlington Island, on the Jersey shore; owned and fished by Captain Van Skiver; seine 200 fathoms, and makes eight hauls a day; at time of visit six hauls had been made and 16 shad caught, with very good catch of herring. Left a spawn-taker here to examine the hauls made at sundown. At 4 p. m. continued up river; stopped at 4.30 and visited two shores half a mile apart, opposite Florence, owned and fished by Captain Powell. One seine measured 150 fathoms, the other 80; hauled only on ebb tide. Reported season's catch of shad very small, but an average catch of herring. About 1 mile above Florence, on the Pennsylvania shore, is Ivens's fishery, owned and fished by William J. Ivens; seine 150 fathoms; fishes it on high water, and all the ebb tide; catch of shad and herring about an average for the season. Had spawn-takers tend hauls at fisheries all the way up, but no ripe fish were found. After examination of Ivens's fishery steamed down the river and anchored off Burlington for the night.

Saturday, May 30.—Sent spawn-takers to tend the hauls at all the fisheries within reach during the day, using launch Cygnet to distribute them at the different stations. At 9 a. m. got under way with Lookout and proceeded up the river to continue the investigation as far as Bordentown, N. J.; at 10 arrived at and anchored near Ellis's fishing shore, situated on Pennsylvania shore, opposite north end of Newhold Island, owned and fished by E. Burt Davis, of Trenton, N. J.; fishes a 120-fathom seine; hauls on high water, and all the ebb tide. While there four hauls were made, 7 shad were caught (3 of which were down-runners), and about 300 herring. The catch of shad for the season had

been so far about 2,500, herring 5,000. As there were no more fishing shores between here and Bordentown I interviewed the gillers, and found that but 5 were fishing in this vicinity, although during the season some 15 had operated. They use a very large mesh, 5¼ to 5½, so that nothing but very large fish are caught. They reported an average season. At 1 p. m. got under way with Lookout and steamed down the river to Burlington, picking up the spawn-takers on the way down, as all the shores stop fishing from Saturday noon until Monday morning. At 2.30 p. m. came to anchor, and concluded to locate in the vicinity, it being near the center, and within easy reach of all the principal fishing shores. Launch Cygnet returned at 4 p. m. with the remainder of spawn-takers, but were not successful in procuring spawn from any of the fishing shores during the day.

Sunday, May 31.—At 5 p. m. sent one spawn-taker down by train to Rivington, near Faunce's fishing shore, to be on hand to tend morning hauls, and to remain there during next Monday.

Monday, June 1.—At 4 a. m. launch Cygnet started with spawn-takers and boats and distributed them at all the fishing shores in the immediate vicinity; at 1.30 p. m. got under way with Lookout and visited the fishing shores. All reported a fair Monday's catch of shad, but no spawning fish were found; at 5 p. m. came to anchor at Torresdale, 4 miles below Burlington, and concluded to tend the gillers at the sundown drift; at 7 p. m. spawn-takers returned with 149,000 shad eggs, obtained from the gillers; at 8 p. m. launch Cygnet returned from Faunce's fishing shore with 159,000 shad eggs, and reported that seine cut out. Placed eggs in McDonald hatching-jars; spawn-takers tended gillers during ebb tide, but failed to procure any spawn. I am pleased to state that the fishermen take a great interest in the work, and seem willing to assist in every way possible. According to instructions from Assistant Commissioner Ferguson, I paid the fishing shores and gillers at the rate of $10 per 1,000,000 for all good impregnated shad eggs.

Tuesday, June 2.—At 6.30 a. m., when spawn-takers returned from tending gillers at morning high water, steamed up the river to Burlington and anchored; at 8.45 got under way, and proceeded up river with launch Cygnet in tow; at 10 arrived at Bordentown, anchored Lookout, and started up river in launch Cygnet to make an investigation of the fisheries as far as Trenton; visited Shamptown fishery, about 1 mile above Bordentown shore, owned and fished by John Seeds, seine 115 fathoms long, season's catch of shad about 2,500; fish reported very scarce now. Had made several hauls, but no shad were caught and but 150 herring. Two other small seines, one on Biles Island and the other on Moon Island, which had operated at those points during the season, I found had cut out. The gillers had nearly all cut out, not more than 10 operating the whole distance from Bordentown to Trenton. All the gillers I interviewed reported a fair season's work; at 1.30

p. m. arrived back to Lookout, got her under way, but in turning in the narrow channel; got aground sent launch Cygnet with boats and spawn-takers down the river, to be in time for sundown drift of gillers near Torresdale; at 4.45 p. m. vessel afloat, and proceeded down the river; at 6 p. m. anchored near Torresdale; at 7 p. m. spawn-takers returned to vessel with 233,000 shad eggs; sent spawn-takers out again, but returned at midnight without any spawn.

Wednesday, June 3.—At 6.30 a. m. got under way and steamed up to Burlington and came to anchor. Had numerous visits from the inhabitants of the place, who seem to take a great interest in the work. At 4.45 p. m. steamed down the river and anchored near Torresdale. Sent launch Cygnet with spawn-takers and boats 8 miles down the river to tend on the gillers in the vicinity of Ten Mile Point. At 7.30 spawn-takers from gillers in the vicinity of vessel returned with 301,000 shad eggs. As all available jars were occupied, I placed some eggs in hatching cones. At 11.30 p. m. launch Cygnet returned with spawn-takers, but failed to procure any spawn. Young fish from eggs obtained on the 1st instant began to hatch out this evening.

Thursday, June 4.—Spawn-takers tended gillers on several drifts during the night, but did not get any more spawn. At 6 a. m. got under way and steamed up to Burlington and came to anchor. Received telegraphic instructions from Assistant Commissioner Ferguson to send launch Cygnet, two spawn-takers, and one boat to Trenton, N. J., to co-operate with Mr. Ellis in gathering spawn for hatching purposes in Fish Commission car No. 3, and also to continue operations on the river with Lookout and proceed to Havre de Grace, Md. I regretted exceedingly that I could not remain in the vicinity a few days longer so as I could show the young fish to the people of Burlington and this vicinity hatched out from spawn obtained here. At 11 a. m. steamed over to Bristol, Pa., took on board 2 tons of coal, and at 1 p. m. steamed down the river, stopping at different points on the way and paying the fishermen for spawn obtained from them. At 3.30 p. m. passed Philadelphia. At 4.30 came to anchor off Gloucester Point, New Jersey. Young fish hatching out very fast.

Friday, June 5.—At 4.30 a m. deposited 15,000 shad fry in the middle of river opposite Gloucester Point. At 5 a. m. got under way and steamed down the river. At 9 a. m. entered the Chesapeake and Delaware Canal. At noon locked out at Chesapeake City, and steamed down Back Creek and Elk River. I have to report that during the time of passing the canal the temperature of the hatching room reached 100°, the temperature of the water in hatching jars increasing accordingly, so that with the great heat and the change of water in the canal 150,000 young fish died. At 3. 30 p. m. arrived at Battery Station, Havre de Grace, Md.; transferred 338,000 eggs and 177,000 young shad fry to superintendent of station; dismantled hatching apparatus,

sent it on shore, and put it in store-room at station, taking receipt for same.

I beg to state that I consider the vicinity of Burlington, N. J., and down the river toward Petty's Island, just above Philadelphia, a good locality for the purpose of procuring spawn for hatching shad. And I would also state that if a party should be sent to that vicinity they should be on the ground ready for work not later than May 10, as from that time to the end of the fishing season a great many ripe fish will be found.

U. S. F. C. STEAMER LOOKOUT,
Port Jefferson, Long Island, N. Y., August 23, 1885.

TABLE I.—*Record of shad-hatching operations conducted at Havre de Grace, Md., and on the Delaware River, on the U. S. Fish Commission steamer Lookout, from May* 13 *to June* 5, 1885, *by James A. Smith, U. S. N.*

Date.		Ripe fish.		Eggs obtained.	Transferred to Battery Station.		Fish deposited.	
Day of week.	Day of month.	Males.	Females.		Eggs.	Fish.	Number.	Place.
	1885.							
Wednesday..	May 13	7	8	217,000	.....	.....	.....	.....
Thursday....	May 14	9	11	338,000	.....	.....	.....	.....
Friday.....	May 15	10	14	529,000	165,000	.....	.....	.....
Saturday	May 16	8	9	322,000	529,000	.....	.....	.....
Monday .. .	May 18	12	19	1,146,000	322,000	.....	100,000	Middle of Delaware River, opposite Faunce's fishery.
Tuesday....	May 19	10	14	950,000	378,000	.....	75,000	Middle of Delaware River, opposite Faunce's fishery.
Wednesday..	May 20	1	1	30,000	348,000	277,000	75,000	Middle of Elk River, Md., opposite mouth of Bohemia Creek.
Monday	May 25	1	1	35,000	35,000	.....	50,000	Opposite Bull Mountain, North East River, Md.
.....	.....	.....	.....	.....	.....	.....	25,000	Opposite Battery Station, in channel.
Monday	June 1	9	10	308,000	.....	.....	.....	.....
Tuesday....	June 2	8	9	233,000	.....	.....	.....	.....
Wednesday..	June 3	10	12	301,000	.....	.....	.....	.....
Friday.....	June 5	.....	.....	.....	338,000	177,000	15,000	Middle of river, opposite Gloucester Point, New Jersey.
Total ..	.....	85	108	4,409,000	2,115,000	454,000	340,000	

TABLE II.—*Record of temperature observations made at Havre de Grace, Md., and Delaware River, on the U. S. Fish Commission steamer Lookout, from May 13 to June 5, 1885, by James A. Smith, U. S. N.*

Date.		Temperature of air.			Temperature of surface water.			Temperature of bottom.			Direction of wind.			Intensity of wind.			Condition of sky.			Condition of water.	State of tide.		
Day of week.	Day of month.	8 a. m.	4 p. m.	12 midnight.	8 a. m.	4 p. m.	12 midnight.	8 a. m.	4 p. m.	12 midnight.	8 a. m.	4 p. m.	12 midnight.	8 a. m.	4 p. m.	12 midnight.	8 a. m.	4 p. m.	12 midnight.		8 a. m.	4 p. m.	12 midnight.
	1885.																						
Wednesday*	May 13	56	58	56	57	58	57	55	55	54	NE.	NE.	NE.	4	4	6	Cloudy	Cloudy	Cloudy	Rough	Flood	Flood	Ebb.
Thursday	May 14	56	60	56	56	60	59	56	58	58	NNW.	N.	NE.	4	4	1	do	B. c	B. c	do	High water	do	Do.
Friday†	May 15	62	72	62	56	62	62	56	61	60	NW.	N.	Calm.	4	2	0	Clear	Clear	Clear	do	Flood	Ebb	Do.
Saturday‡	May 16	67	84	58	59	65	61	59	62	62	NNE.	NE.	NE.	3	5	2	do	B. c	do	do	do	do	Do.
Sunday	May 17	59	64	53	61	61	60	61	60	58	E.	E.	SE.	4	3	4	do	B. c	B. c	do	do	Flood	Flood.
Monday	May 18	56	82	63	59	61	60	58	62	60	NE.	NNE.	Calm.	3	3	0	B. c	B. c	Clear	Smooth	Ebb	do	Ebb.
Tuesday	May 19	80	80	64	61	63	62	60	62	62	NNW.	SW.	NE.	2	2	2	Clear	O. c	Cloudy	do	do	do	Do.
Wednesday	May 20	88	80	67	69	70	69	69	69	69	Calm.	SE.	E.	0	6	1	Overcast	Squally	Overcast	Rough	do	Ebb	Flood
Thursday	May 21	68	80	62	69	72	69	68	71	66	E.	E.	ESE.	4	3	7	do	Cloudy	do	do	do	do	Do.
Friday	May 22	62	70	63	69	70	68	69	70	66	ENE.	E.	ESE.	4	3	7	do	Rain	Cloudy	do	do	do	Do.
Saturday	May 23	68	....	....	68	....	....	68	....	....	E.	....	....	1	....	....	do	....	....	Smooth	do	....	....
Monday§	May 25	....	....	72	....	....	70	....	....	69	....	....	NW.	....	....	9	....	....	Rain	do	....	....	Ebb.
Monday	June 1	....	....	67	....	....	66	....	....	67	....	....	W.	....	....	4	....	....	Clear	do	....	....	Do.
Tuesday	June 2	64	77	60	67	71	68	67	70	66	NNW.	WNW.	NE.	6	3	2	Clear	B. c	do	Rough	Ebb	Flood.	Do.
Wednesday	June 3	60	78	59	68	72	69	68	71	66	NE.	Calm.	S.	1	0	4	do	do	do	Smooth	do	do	Do.
Thursday	June 4	65	78	72	69	71	70	69	70	69	SE.	SW.	SSW.	1	2	1	B. c	do	B. c	Rough	High water	do	Do.
Friday	June 5	80	....	....	71	....	....	71	....	....	SW.	....	....	7	....	....	....	....	do	do	Ebb	....	....

* Weather overcast and rainy. † Water thermometer No. 5213, broken. ‡ Water thermometer No. 5264 in use.
§ No eggs taken; no hatching going on from Monday, May 25, to June 1, 1885.

132.—REPORT OF THE OPERATIONS OF THE U. S. FISH COMMISSION STEAMER FISH HAWK, IN SHAD HATCHING, ON THE DELAWARE RIVER, SEASON OF 1885.

By L. W. PIEPMEYER,

Ensign, U. S. N., Commanding.

I have the honor to make the following report of the operations of the steamer Fish Hawk in the shad-hatching work on the Delaware:

In obedience to your order of May 19, 1885, I proceeded on the next day down the Potomac River and Chesapeake Bay, and up the Delaware, arriving at Gloucester Point, New Jersey, at 1 p. m., May 23, having been detained at Cape Henry by heavy easterly squalls, and at Delaware Breakwater by a thick fog. Hoisted out steam-launch, and steamed down the river to interview fishermen.

May 23.—The first fishing shore I visited was owned by Howell & Hunt. Mr. Howell was at first decidedly averse to having any of our men handle his fish, stating that some men who had been there before the arrival of the Fish Hawk had handled his fish so roughly as to render them unsalable. I, however, finally persuaded him to give our men a trial, promising him that they should be very careful, and agreeing to pay for all fish they might spoil. I agreed to pay for all spawning shad 25 cents for each female, or $10 per 1,000.000 for all impregnated eggs. For the use of milters no compensation was allowed. This shore is known as the Gloucester Point fishery.

I next visited two other fisheries owned and managed by Rice & Bakeoven. They are the Howell's Cove fishery and the Eagle Point fishery. I made arrangements with both the managers, and found them disposed to assist.

I also made arrangements with a number of gillers, offering them $20 per 1,000,000 for all impregnated eggs, in good condition, that they might deliver on board, and the same terms for such as they gave the spawn-takers as the owners of seines were to receive. All the gillers I talked with were favorably disposed, and seemed to appreciate the importance of the work.

It being Saturday afternoon all the seines had hauled up for Sunday, and no more fish will be taken until Monday morning. Mr. F. N. Clark joined the ship.

May 25.—I sent out five spawn-takers, two to Gloucester Point, two to Howell's Cove, and one to Eagle Point. Three of my men, under instructions at Havre de Grace, had not returned, but arrived in the afternoon.

The New Jersey fish commission came on board and inspected the hatching apparatus. They urged the advisability of having the Fish Hawk co-operate with them in their hatching operations about Trenton later in the season.

At 5 p. m. I got under way and steamed down the river about 6 miles, and at 6 p. m. anchored off Faunce's fishery. Mr. Clark and I visited Faunce's seine haul, and another owned by the Bakeoven Brothers. Made arrangements with both to procure spawn. Got 98,000 eggs from Faunce's in the one haul we were able to attend, 504,000 from Howell's Cove, 266,000 from Eagle Point; total, 868,000 eggs. No returns from Gloucester Point.

May 26.—Early in the morning I finished the examination of the fishing shores. There is one just above Billingsport, and one about 2 miles below. The one above is owned by one of the Faunces, and the one below by Bennett Brothers. The one just above Billingsport cut out in the evening. The total number of eggs received this day was 434,000. But few fish were caught; total to date, 1,302,000. We have as yet received no eggs from Gloucester Point, and the gillers are doing very poorly, catching very few, and none ripe.

In the evening I anchored above the Schuykill, with the idea of avoiding the oil coming out of that river.

May 27.—The total number of eggs taken to-day was 943,000. Of this number 167,000 were taken from gillers. One giller refused to allow his fish to be overhauled because the spawn-taker could not pay cash. In future I shall provide my men with a little money, so as to be prepared for a similar case.

Mr. Clark's assistants arrived to-day. They went out among the gillers, but were unsuccessful. No eggs have as yet been obtained from Gloucester Point. The eggs put in the cones and jars on the 25th and 26th are doing well. Some of the 25th are nearly hatched out.

May 28.—The spawn-takers got 677,000 eggs to-day, 64,000 from Howell's Cove, 457,000 from Bennett's fishery, and 156,000 from Eagle Point; total to date, 2,922,000. Five shores were attended.

May 29.—Result of the day's work as follows: Howell's Cove, 640,000; Faunce's, 110,000; Bennett Brothers, 143,000; total, 893,000; total to date, 3,815,000.

Yesterday 156,000 eggs were taken from one shad at Eagle Point fishery, owned by Rice & Bakeoven. The eggs were brought in by Jacob Svedlin, quartermaster, and carefully measured. He stated that he had stripped only one shad. Mr. Clark and I visited the fishery this morning and obtained the corroborative evidence of Mr. Bakeoven and one of the men. I am satisfied that it is true. The fish weighed about 6 pounds.

Eggs and young fish apparently in good condition. A few dead eggs have been removed from the surface.

May 30.—Spawn was obtained from Howell's Cove, 160,000 eggs from two fish. No haul was made later than 4 p. m., all the seines being hauled up for Sunday.

This afternoon I took 250,000 young fish down to Rice & Bakeoven's fisheries, to show the fishermen some of the results of the hatching

work. The exhibition aroused considerable enthusiasm, both owners and employees examining the small fry with great interest. They are quite enthusiastic, and help our men in every possible way. After they had all seen and examined the fish I put the fry overboard.

June 1.—This being Monday, with the wind in a favorable direction, the catch was large and the yield of spawn was in proportion. We got from Howell's Cove 1,025,000, from Faunce's 350,000, from Bennett's 362,000; total for the day, 1,737,000; total to date, 5,712,000. Gloucester Point has not yet furnished any eggs. I have taken the spawn-takers away from that shore and shall utilize them among the gillers. The launch being disabled I attended the boats with the ship and anchored in the evening off Faunce's fishery, below Red Bank. I took young fish ashore at Faunce's and Bennett's, and after showing them I put them overboard in deep water. I have deposited up to date 985,000 young fry.

June 2.—Received spawn as follows: Howell's Cove, 454,000; Bennett's, 260,000; Faunce's, 148,000; total, 862,000. Sent spawn-takers among the gillers, but without results.

June 3.—Number of eggs received to-day, 1,004,000, as follows: 184,000 from Bennett's, 692,000 from Howell's Cove, 128,000 from Eagle Point. Deposited yesterday and to-day, 1,100,000.

June 4.—All the fisheries except Howell's Cove have cut out. From this fishery we obtained to-day 1,120,000 eggs. Rice & Bakeoven are barely making expenses, but will hold on until next Monday in the hope of a good haul after Sunday. The proportion of ripe fish is increasing, but the number of fish caught is decreasing. Put over to-day 1,170,000 young fish.

June 5.—Obtained 564,000 eggs to-day, making a total of 9,270,000. Deposited 496,000 young fry.

June 6.—No ripe fish to-day. At noon the seine was hauled up for Sunday. Put overboard 700,000 young shad from eggs obtained on the 1st.

June 8.—Eight thousand eggs were obtained from gillers, but all died and were thrown overboard. They were in bad condition when received on board, owing to the rough weather.

June 9.—To-day 596,000 were obtained from Howell's Cove. Owing to the rough weather, the eggs were received in a bad condition, and I am afraid that only a small proportion will hatch out. The eggs were obtained by the spawn-takers at 10 p. m. and could not be put on board and in the hatching apparatus until 4 a. m. to-day. Deposited 1,346,000 young fish from eggs obtained on the 2d and 3d instants.

Eggs received to date, 9,874,000. Howell's Cove will cut out to-night. I have seen the owners in reference to continuing the fishing after the 10th, but find that the compensation for eggs will not induce them to fish after the close of the season, even if permission could be obtained.

Besides, the grass is so heavy that in a few days it would be almost impossible.

June 10.—Howell's Cove has cut out. Received last night 738,000 eggs. Deposited 896,000. Total number of eggs received during the season, 10,604,000. I shall proceed to Burlington, N. J., to finish hatching the eggs on board, and put them over at that place.

June 11 and 12.—Steamed up to Burlington, N. J., and lay there for two days. Put over 450,000 young fish. Found that only 200,000 of the eggs received on June 9 hatched out.

June 13.—I left Burlington and proceeded to Port Richmond, filled up with coal and stores, and steamed down the bay. Put over the remaining young fish, 670,000, which had just hatched out, off Billingsport.

REMARKS.—I regard the Delaware as an excellent field of operations for the Fish Commission during the shad season. At the time the Fish Hawk arrived there the fish had evidently been spawning for some time. We were told stories of much larger catches of fish than any that took place while we were there. Though it is probable that the proportion of ripe fish was not so great at that time, still out of these great numbers it is to be supposed that many spawning fish might have been obtained.

All the principal shores are from 4 to 12 miles below Philadelphia. What effect the oil and other impurities in the water may have on the young fish I am not prepared to state, though I have several times observed a sluggishness in their movements that I can ascribe to no other cause. I think it would be well if the young fish or the partly developed eggs could be transported to some point at least 10 miles above Philadelphia.

We have obtained by far the largest number of eggs from the Howell's Cove fishery, 7,156,000 out of a total of 10,604,000; while from the Gloucester Point fishery none were received.

The two shores almost join each other. The first is a comparatively retired cove, with a decided curve inland, well clear of the channel, while the other is a straight shore, near the channel, and near the Gloucester ferry slip.

Faunce's seine haul, though we did not get so many ripe fish there as at Bennett's, has a reputation for big roe shad. It is also well out of the main channel. It is said to have numerous springs at the bottom. Bennett's is also said to have springs at the bottom.

I think that with an earlier start next season, the work of this year can be doubled or trebled.

I append a table showing in statistical form the number of eggs received, proportion hatched out, time of hatching, disposition, temperature, &c.

Record of shad hatching on the Delaware River from May 25 to June 10, 1885.

Date.	Station.	Fishery.	Kind of fish.	Number of— Males.	Females.	Eggs taken.	Time put in cones.	Time of hatching.	Number hatched.	Number deposited.	Time deposited.	Where deposited.	State of water.	Temperature of air. Max.	Min.	Temperature in cones. Max.	Min.
1885.								*Days.*									
May 25	Fish Hawk	Howell's Cove	Shad	13	13	504,000	8.45 p. m.	5½	380,000	380,000	May 30	Delaware River	Clear	79	57	68	65
25	do	Eagle Point	do	6	6	266,000	8.45 p. m.	5½	215,000	215,000	May 31	do	do	79	57	68	65
25	do	Faunce's	do	4	3	98,000	9.45 p. m.	5½	60,000	60,000	May 31	do	do	79	57	68	65
26	do	Eagle Point	do	5	5	95,000	8.30 p. m.	5½	55,000	55,000	May 31	do	do	82	67	69	67
26	do	Howell's Cove	do	5	5	167,000	8.30 p. m.	5½	150,000	150,000	June 1	do	do	82	67	69	67
26	do	Faunce's	do	8	6	172,000	9.00 p. m.	5	125,000	125,000	June 1	do	do	82	67	69	67
27	do	do	do	7	6	118,000	8.30 p. m.	5	100,000	100,000	June 2	do	Muddy	76	64	69	68
27	do	Bennett's	do	10	7	226,000	9.00 p. m.	5	200,000	200,000	June 2	do	do	76	64	69	68
27	do	Howell's Cove	do	12	12	432,000	9 30 p. m.	5	350,000	350,000	June 2	do	do	76	64	69	68
27	do	Giller's	do	3	3	167,000	11.30 p. m.	5	150,000	150,000	June 2	do	do	76	64	69	68
28	do	Howell's Cove	do	3	3	64,000	7.30 p. m.	5	60,000	60,000	June 2	do	Partly clear	74	60	68	66
28	do	Bennett's	do	15	10	457,000	9.30 p. m.	5	420,000	420,000	June 3	do	do	74	60	68	66
28	do	Eagle Point	do	2	1	156,000	9.45 p. m.	5	125,000	125,000	June 4	do	do	74	60	68	66
29	do	Howell's Cove	do	11	11	640,000	8.30 p. m.	5	515,000	515,000	June 4	do	do	72	56	67	67
29	do	Faunce's	do	5	3	110,000	8.30 p. m.	5	100,000	100,000	June 4	do	Muddy	72	56	67	67
29	do	Bennett's	do	5	5	143,000	9.00 p. m.	5	115,000	115,000	June 4	do	do	72	56	67	67
30	do	Howell's Cove	do	2	2	160,000	6.00 p. m.	5	135,000	135,000	June 4	do	do	69	57	66	66
June 1	do	Bennett's	do	7	7	196,000	7.30 p. m.	5	166,000	166,000	June 5	do	Partly clear	80	62	68	65
1	do	do	do	7	7	166,000	10.30 p. m.	5	155,000	155,000	June 5	do	do	80	62	68	65
1	do	Howell's Cove	do	20	20	1,025,000	10.00 p. m.	5	700,000	700,000	June 5	do	do	80	62	68	65
1	do	Faunce's	do	12	12	350,000	*2.00 a. m.	5	175,000	175,000	June 5	do	do	80	62	68	65
2	do	do	do	5	5	148,000	8.00 p. m.	5	74,000	74,000	June 7	do	do	78	64	68	67
2	do	Howell's Cove	do	14	14	454,000	9.00 p. m.	5	304,000	304,000	June 7	do	Clear	78	64	68	67
2	do	Bennett's	do	10	8	260,000	9.00 p. m.	5	200,000	200,000	June 7	do	do	78	64	68	67
3	do	do	do	5	5	92,000	10.45 p. m.	5	83,000	83,000	June 8	do	do	76	59	68	67
3	do	Howell's Cove	do	16	16	692,000	11.45 p. m.	5	500,000	500,000	June 8	do	do	76	59	68	67
3	do	Eagle Point	do	3	3	128,000	11.45 p. m.	5	102,000	102,000	June 8	do	do	76	59	68	67
3	do	Bennett's	do	2	2	92,000	11.45 p. m.	5	83,000	83,000	June 8	do	do	76	59	68	67
4	do	Howell's Cove	do	20	20	1,120,000	11.45 p. m.	5	896,000	896,000	June 8	do	Muddy	79	60	70	68
5	do	do	do	9	9	564,000	12.00 p. m.	5	450,000	450,000	June 12	do	do	83	59	72	70
8	do	Gill boat	do	1	1	8,000	10.00 p. m.	(†)						80	64	71	70
9	do	Howell's Cove	do	14	14	596,000	6.00 a. m.	4	200,000	200,000	June 13	Delaware River	do	68	56	70	69
10	do	do	do	12	12	738,000	1.00 a. m.	4	720,000	720,000	June 13	do	do	76	59	70	70
	Total			273	256	10,604,000			8,063,000	8,063,000							

*2 a. m. of June 2.

† Died before hatching, and thrown overboard.

133.—FALLING OFF IN THE FISHERIES OF MALTA.

By JOHN WORTHINGTON.

[Dispatch No. 97 to the State Department.]

The fish question has come to be a very serious one for the inhabitants of these islands. Year by year the supply of fish has been gradually falling off in Maltese waters, until less than one-half the number of fishermen are engaged in the industry now that were engaged in it twenty-five years ago. Fish having become comparatively scarce, the prices have advanced proportionately, and not a few of the poorer class of the population are unable to afford themselves fish at all. The fish that are caught in the deep water off the shores are of excellent quality, but of migratory habits. When, however, the seasons arrive for the taking of the better grades of fish, it is found that the yearly catch continues to decrease, and at such a rate that considerable anxiety has arisen lest the supply will ultimately fail entirely unless measures are taken not only to prevent further depopulation, but also to preserve, cultivate, and increase the yield. I believe the bays and coasts of Malta are well adapted for the propagation of fish, but proper and intelligent measures need adoption and accomplishment before they can be made to supply the demand. With the end in view of increasing and fostering the fisheries of the island, a fish commission has been formed in Malta.

I have received an official communication, dated Valetta, Malta, January 7, 1885, from Walter Hely-Hutchinson, lieutenant-governor and chief secretary of the Government of Malta, which is as follows:

"A commission is at present sitting in Malta with a view of inquiring into the fishery regulations.

"The committee has to be supplied with any information that can be obtained on the subject of the preservation and culture of marine fish which may be available.

"I am given to understand that instructive and interesting information on this subject can be obtained from America.

"I am directed by his excellency the governor to ask whether you would be in a position to furnish me with any such information.

"I assure your Department that any information it may furnish the Malta Government on this important subject will be gratefully received and highly appreciated by the governor and the Maltese people."

If it is within the province of the Department to obtain from the United States Fish Commission, or from other sources, any information which may meet this request, I shall be happy to receive and impart it to the Government of Malta.

UNITED STATES CONSULATE,
Malta, January 10, 1885.

Vol. V, No. 26. Washington, D. C. Sept. 28, 1885.

134.—REPORT OF SHAD-HATCHING OPERATIONS AT BATTERY STATION, HAVRE DE GRACE, MD., SEASON OF 1885.

By WILLIAM HAMLEN,

Superintendent of Battery Station.

I have the honor to submit herewith my report of the operations in shad-hatching at this station during the spring of 1885, accompanied by tables showing in detail the work performed.

Although the work of the present year about trebled that done last season, the capacity of the station was by no means taxed to its utmost. It is needless to say that advantage was taken of every opportunity to make the work successful, and to accomplish all that was expected of the station.

The season was unusually backward, and we were much inconvenienced by the prolonged presence of ice in the river, which cut off communication with Havre de Grace, Md. On the island, however, the preparations for the work were steadily pushed forward.

The system pursued during the spring of 1884, of fishing the seine by contract, did not result as satisfactorily as was hoped, and it was deemed best not to attempt the same experiment this year. It being necessary to have the services of an experienced fisherman to act as captain of the seine, the position was offered to Mr. Everett Thompson, a citizen of Havre de Grace, and was accepted. Mr. Thompson reported at the station April 1st with two seine-menders and riggers, when the seine was removed from its storage, ropes taken out, and the operation of rigging the net commenced. Such dispatch was used that by the 14th of April this work was completed, although interrupted on several occasions by stormy weather. When ready for fishing the seine measured 1,280 fathoms in length.

While the seine was being rigged, attempts were made to sweep the hauls to remove any obstructions which might have lodged from the spring rains and freshets. As the ice did not leave the river until almost time for fishing operations to commence, and as the force was at this time inadequate to perform all that was necessary to be done to put the station on a proper footing for the season's work, the U. S. Fish Commission steamer Fish Hawk was ordered here for the purpose of clearing out these obstructions, and for rendering any assistance necessary to equip the station thoroughly. She arrived on April 2, and her crew was put to work with small boats and launches to clean the hauls. The work, however, was much interrupted by the heavy and continual

freshets in the river, caused by the early rains and the melting of snow and ice, so that the work was not satisfactorily completed until the 23d of the month. Mr. Piepmeyer, commanding the vessel, reported to the Commissioner, and received orders to proceed to Havre de Grace, coal ship, and leave for Washington. On the 24th the steamer left the station for the coal wharf, and on the 25th passed again on the way to Washington.

On the 2d of April, under orders from the Commissioner, Launch No. 68 left Battery Station for the Potomac River to assist in the shad work at that point. Launch No. 82 was ordered to accompany her as far as fresh water in the Potomac, because of the inability of No. 68 to travel in salt water after the supply of fresh water for her boilers had become exhausted, while No. 82 is furnished with a keel condenser. The trip was successfully made, and Launch No. 82 returned to this station on April 13.

During the first two weeks of April the force was daily increased until by the 16th the entire gang for fishing the seine was complete. The weather still continued cold and stormy, and interfered much with the success of the season's work.

On the 16th of April the first haul of the seine was made, and it was thereafter worked regularly and thoroughly until the 27th of May, when the force was discharged, and fishing operations ceased. In the period during which the seine was worked, 109 hauls were made, 50 ebb and 59 flood. The total catch of shad for the season was 3,512; only 167,125 herring were hauled, as there was no market for fresh fish, and the commission was not prepared to salt.

The catch of shad was far below that anticipated at the beginning of the season, but the cause is attributable to many unavoidable circumstances. The backward season, continual storms, muddy water in the river, and principally the condition of the apron upon which the seine was landed, all contributed to make the season as non-productive as it proved.

Much trouble was experienced with this apron last year, and one of the first moves the present season was an examination as far as practicable into its condition. It was discovered that a large portion of the apron was off the bottom, which would afford an easy avenue of escape for the fish on the landing of the seine, and efforts to remedy this were made by piling dirt and gravel along the edge of the apron to force the sill down level with the bottom, or to fill up the open space referred to. After this was done an examination showed that the apron was much improved, though by no means satisfactory. However, as the season was upon us we had to do the best possible under the circumstances. Later on will be submitted recommendations with reference to this matter.

The herring came on in the greatest abundance this year, constantly

crowding the seine to such an extent that it became necessary to allow these fish to escape, as there was no way of taking care of them.

The hatching house had been placed in order for the reception of shad eggs, and on the 21st of April the first instalment of eggs was received. From this time until the close of the season, June 11, eggs were taken daily from the fish captured in the seine and from the floats and gillers operating in the neighborhood. It will be seen by reference to the accompanying tables of operations that the yield of eggs from the seine was 1,253,000, and from the gillers and other sources 12,104,000, making a total of 13,357,000. Of this number there was an aggregate loss of 3,065,000, thus leaving as fish hatched 10,292,000. This number was augmented from outside sources by 433,000, as will be shown by an examination of the table of hatching operations. With this addition the number of shad produced was 10,725,000, which were about evenly distributed between the waters about the station and streams in other localities and States. The accompanying table of distribution will show each deposit.

During the season reports were received that large numbers of ripe shad were being captured on the eastern side of the bay by the gillers operating in that neighborhood between Carpenter's and Turkey Points. A portion of the force was sent out to attend these fishermen as far as practicable, but the distance was so great and the time of lifting the nets so inconvenient that it was found impossible to work this neighborhood as thoroughly as was desired.

Accordingly, under orders from the assistant commissioner, the steamer Lookout arrived at the station on May 13, for the purpose of gathering eggs from this locality. She left the station each night, carrying two expert spawn-takers and an extra boat, and returned next morning. The eggs which could not be accommodated in the equipment of the vessel were then transferred to the station. This work was continued until May 17, when, with Assistant Commissioner Ferguson on board, the Lookout left for a visit of inspection of the Delaware River, where it was reported shad were being caught in great abundance. The vessel returned to the station on the 20th, after a very successful trip, having obtained in the short time there nearly 2,000,000 eggs, only a portion of which, however, was transferred to the hatching house at this station. After the return of the steamer the nightly trips to the eastern shore were resumed and continued until May 27, when the vessel again left for the Delaware River, taking an expert spawn-taker.

In all cases when the steamer transferred eggs to Battery Station due credit was given for the number, and a careful reference to the table of hatching operations will show that during the season the station received from the vessel 2,087,000 eggs, and 433,000 young shad.

The work on the Delaware proving so successful, the Commissioner ordered Launch No. 82, on duty at this station, to proceed to that locality

with an extra boat and two first-class spawn-takers, to assist the steamer Lookout. The launch, under Cockswain Cleaveland, left on May 28, and returned June 7.

POOL EXPERIMENTS.—The experiment attempted in previous years of confining unripe shad in the pool until they had become sufficiently "soft" to yield spawn, was repeated this season, but with little or no success.

Several seine hauls of fish were turned into the pool, and at intervals the shad would be removed and examined. Most of those captured proved "hard" or "rotten ripe," and but a very small number of eggs was obtained from this source. The few eggs taken had the appearance of being sound and healthy at the time of stripping, but soon after being placed in the hatching jars, would form into knots. No fish were produced from the eggs thus obtained, and I again advance the opinion that this experiment is not practicable. The shad are unused to a confined space like the pool, and are eager to escape. Failing in this, they become frightened and rush against the sides of the pool and the wire grating of the gates, bruising themselves severely, causing the appearance of fungus, and afterwards death. Probably another cause of failure this season was the presence in the pool of herring in such large numbers. Their continual agitation stirred up the mud and sediment on the bottom, and the sliming of the water, in addition, made it extremely unwholesome, large numbers of fish dying daily.

Another and dangerous feature was noticed in this connection. The water used in the jars for hatching purposes was pumped from this pool into the two large tanks in the water-tower, whence it passed through pipes into the hatching house. About the 18th of May, when the pool was crowded with shad and herring, it was noticed by the attendants of the hatching house that the water was flowing less freely, and the eggs began to present a dirty and sickly appearance. A prompt investigation showed that the water contained large quantities of dirt and slime caused by the fish in the pool. The water was immediately turned off and the pipes and jars thoroughly cleaned. It was proposed to remedy this evil by running a new suction pipe outside of the pool, and sufficient pipe for the purpose was ordered; before it arrived, however, the condition of the eggs became such as to make it imperative that the cause of this pollution should be removed. Accordingly, on my earnest recommendation, the assistant commissioner instructed that the pool gates be opened and the fish allowed to escape. This was done at once, and in a short time, the eggs resumed their normal condition.

The experiments designed with the pool were thus practically ended for this season, as the catch of fish after the opening of the gates was so small that the seine was stopped a few days after.

By judicious management and untiring application on the part of

experts Sauerhoff and Tolbert, who were in charge of the hatching house, the loss of eggs from the pollution of the pool water, although of considerable extent, was kept as low as possible.

Every effort was made to prove the feasibility of this pool experiment, but without success. To facilitate the hauling of the pool seine, and also to allow more space for the fish, the several interior aprons and bulkheads were removed this spring, and one apron only was placed in the northern end of the pool. This worked more satisfactorily than the first arrangement. By the direction of the assistant commissioner, a space of some 20 feet was netted off in the entrance to the pool with nets of different sized meshes. When a haul of fish was turned into this space, the small fish and herring would pass through the larger mesh into the pool, leaving the shad. At intervals the shad would be examined, but always proved "hard" or "rotten ripe."

As stated above, it is my belief that the experiment of penning shad until ripe is not practicable, experience having shown that it is only when fish are captured ready to deposit spawn that good eggs are obtained.

HERRING.—During the season attempts were made to hatch the eggs of the herring, but the apparatus used was not adapted to this work, and little success was attained. However, by careful management, some 200,000 young herring were produced, and placed in the waters about the station.

PERCH.—Several very large, ripe perch being caught in the seine, their eggs were taken and impregnated. A Chase jar was used in developing them, after which the fry were deposited in the neighborhood of the station. During the season 1,250,000 eggs of the perch were obtained, from which number 1,000,000 fish were hatched and planted.

HAVRE DE GRACE, MD., *June* 30, 1885.

TABLE I.—*Record of shad-hatching operations conducted at Battery Station, Maryland, from April 16 to June 11, 1885, under direction of William Hamlen, superintendent.*

Date.		Fish taken in battery seine.		Ripe shad.		Eggs from seine.	Eggs from gillers and other sources.	Total eggs.	Loss of eggs.	Fish hatched.	Fish deposited in local waters.	Fish deposited in other waters.
Day of week.	Day of month.	Shad.	Herring.	Males.	Females.							
Thursday	Apr. 16	.....	675	.....	.....	.....	.....	.....	.....	.....	.....	.....
Friday	Apr. 17	6	6,200	.....	.....	.....	.....	.....	.....	.....	.....	.....
Saturday	Apr. 18	5	4,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Monday	Apr. 20	88	6,750	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tuesday	Apr. 21	160	28,000	.....	.....	.....	10,000	10,000	5,000	5,000	.....	.....
Wednesday	Apr. 22	138	13,000	2	1	14,000	50,000	64,000	4,000	60,000	.....	.....
Thursday	Apr. 23	185	25,000	2	2	28,000	.....	28,000	8,000	20,000	.....	.....
Friday	Apr. 24	131	13,000	6	4	80,000	55,000	135,000	24,000	111,000	.....	.....
Saturday	Apr. 25	111	.....	3	3	112,000	125,000	237,000	61,000	176,000	.....	.....
Monday	Apr. 27	80	15,000	2	2	85,000	229,000	314,000	99,000	215,000	.....	.....
Tuesday	Apr. 28	153	.....	8	7	213,000	.....	213,000	68,000	145,000	.....	.....
Wednesday	Apr. 29	38	12,000	.....	.....	.....	122,000	122,000	20,000	102,000	.....	.....
Thursday	Apr. 30	165	3,000	3	2	55,000	.....	55,000	33,000	22,000	85,000	.....
Friday	May 1	90	5,000	4	1	35,000	48,000	83,000	28,000	55,000	.....	.....
Saturday	May 2	25	.....	2	2	65,000	50,000	115,000	7,000	108,000	.....	.....
Monday	May 4	195	2,000	1	1	28,000	363,000	391,000	45,000	346,000	.....	.....
Tuesday	May 5	132	4,000	.....	.....	.....	322,000	322,000	79,000	243,000	.....	.....
Wednesday	May 6	162	.....	4	4	125,000	260,000	385,000	166,000	219,000	.....	[1]300,000
Thursday	May 7	32	.....	1	1	80,000	.....	80,000	38,000	42,000	.....	.....
Friday	May 8	186	.....	.....	.....	.....	60,000	60,000	4,000	56,000	.....	.....
Saturday	May 9	72	.....	.....	.....	.....	.....	.....	.....	.....	473,000	.....
Sunday	May 10	.....	.....	.....	.....	.....	25,000	25,000	10,000	15,000	.....	.....
Monday	May 11	157	8,000	2	2	101,000	467,000	568,000	88,000	480,000	.....	.....
Tuesday	May 12	68	3,000	.....	.....	.....	153,000	153,000	22,000	131,000	.....	260,000
Wednesday	May 13	61	5,000	1	1	42,000	147,000	189,000	28,000	161,000	.....	.....
Thursday	May 14	[2]115	[3]5,000	1	*1	19,000	[4]622,000	641,000	84,000	557,000	506,000	.....
Friday	May 15	151	.....	2	2	44,000	[5]654,000	698,000	113,000	585,000	.....	.....
Saturday	May 16	9	.....	.....	.....	.....	[6]1,190,000	1,190,000	219,000	971,000	.....	.....
Sunday	May 17	.....	.....	.....	.....	.....	941,000	941,000	296,000	645,000	245,000	.....
Monday	May 18	122	.....	3	2	35,000	1,242,000	1,277,000	[7]499,000	778,000	56,000	.....
Tuesday	May 19	179	3,500	5	3	62,000	687,000	749,000	268,000	481,000	.....	.....
Wednesday	May 20	25	5,000	.....	.....	.....	[8]592,000	592,000	239,000	353,000	440,000	.....
Thursday	May 21	24	.....	.....	.....	.....	70,000	70,000	4,000	66,000	573,000	[9]1,250,000
Friday	May 22	[10]148	.....	.....	.....	.....	105,000	105,000	44,000	61,000	300,000	.....
Saturday	May 23	17	.....	.....	.....	.....	[11]377,000	377,000	.....	[12]652,000	674,000	.....
Sunday	May 24	.....	.....	.....	.....	.....	168,000	168,000	10,000	158,000	500,000	[13]1,500,000
Monday	May 25	176	.....	.....	.....	.....	[14]270,000	270,000	28,000	242,000	125,000	.....
Tuesday	May 26	63	.....	2	1	30,000	327,000	357,000	80,000	277,000	150,000	.....

Wednesday[15]	May 27	43					212,000	212,000	14,000	198,000	100,000	[16] 250,000
Thursday	May 28						77,000	77,000	5,000	72,000		[17] 250,000
Saturday	May 30						184,000	184,000	14,000	170,000		[18] 250,000
Monday	June 1						705,000	705,000	133,000	572,000		[19] 251,000
Tuesday	June 2						454,000	454,000	69,000	385,000		
Wednesday	June 3						300,000	300,000	50,000	250,000		[20] 270,000
Thursday	June 4						80,000	80,000	15,000	65,000		
Friday	June 5						[21] 301,000	301,000	42,000	{ [22] 259,000 / 158,000	} / {	[23] 200,000
Saturday	June 6						35,000	35,000	2,000	33,000	158,000	[24] 500,000
Tuesday	June 9						25,000	25,000				[25] 400,000
Wednesday	June 10										601,000	
Thursday	June 11									25,000	{ [26] 25,000 / 33,000	}
Total		3,512	167,125	54	42	1,253,000	12,104,000	13,357,000	3,065,000	10,725,000	5,044,000	5,681,000

[1] Delivered to Messenger Donnelly.
[2] 13 from pool.
[3] From pool.
[4] 165,000 from steamer Lookout.
[5] 529,000 from steamer Lookout.
[6] 332,000 from steamer Lookout.
[7] Heavy losses of eggs at this time caused by impurity of water in pool, owing to the muddying and sliming of same by large number of fish therein.
[8] 348,000 from steamer Lookout.
[9] Car No. 3, for the Hudson River.
[10] 76 shad from pool.
[11] 377,000 eggs from Lookout.
[12] 275,000 fish from Lookout.
[13] Car No. 3, for Dan River.
[14] 35,000 eggs from Lookout.
[15] Cut out seine to-day.
[16] Messenger Donnelly, for North East River.
[17] Messenger Donnelly, for Gunpowder River.
[18] Messenger Donnelly, for Patapsco River.
[19] Messenger Donnelly, for Elk River.
[20] Messenger Donnelly, for Chester River.
[21] 301,000 eggs from Lookout.
[22] 158,000 fish from Lookout.
[23] Donnelly, for Bush River.
[24] Donnelly, for Susquehanna River, Sunbury, Pa.
[25] Donnelly, for ——.
[26] 25,000 eggs in process of hatching turned out into river by reason of stoppage of pumps furnishing jars.

* Partly ripe.

NOTE.—Excess of 433,000 fish hatched caused by transfer of that number to station by steamer Lookout—May 23, 275,000; June 5, 158,000.

TABLE II.—*Record of temperature observations made at Battery Station, Maryland, on the Susquehanna River, from April 1 to June 11, 1885, by William P. Sauerhoff and George H. Tolbert.*

Date.	Temperature of air.			Temperature of surface water.			Temperature of hatching-house.			Direction of wind.			Intensity of wind.			Condition of sky.			Condition of water.	State of tide.		
	7 a. m.	12 m.	p. m.	7 a. m.	12 m.	6 p. m.	7 a. m.	12 m.	6 p. m.	7 a. m.	12 m.	6 p. m.	7 a. m.	12 m.	6 p. m.	7 a. m.	12 m.	6 p. m.		7 a. m.	12 m.	6 p. m.
1885.																						
Apr. 1[1]	43	60	58	38	39	39	...	...	...	...	...	NE.	Calm	Calm	Light	Clear	Clear	Clear	Muddy	Flood	Ebb	Flood.
2[1]	42	50	49	38	39	39	...	...	...	NE.	SE.	.....	Fresh	Light	Calm	Cloudy	do	do	do	do	do	Ebb.
3[2]	46	60	58	38	39	39	...	...	...	S.	SW.	SW.	Light	Fresh	Light	Clear	do	do	do	do	do	Flood.
4[3]	40	45	44	38	38	39	...	...	...	NW.	NW.	NW.	Strong	Strong	Strong	Cloudy	Cloudy	Cloudy	do	do	do	Do.
5[4]	36	52	50	38	40	40	...	...	...	SW.	SW.	SW.	Moderate	Fresh	Fresh	Clear	Clear	Clear	do	do	do	Ebb.
6[4]	38	58	54	39	40	40	...	...	...	W.	NW.	NW.	do	do	do	do	do	do	do	do	do	Do.
7[4]	42	56	47	40	40	41	...	...	...	W.	.....	E.	Light	Calm	Light	Clear	Cloudy	Cloudy	do	Ebb	Flood	Do.
8[4]	49	58	50	42	43	43	...	...	...	NE.	SW.	NW.	do	Light	Strong	Cloudy	do	do	do	do	do	Do.
9[5]	40	44	43	42	42	48	...	...	...	NW.	NW.	NW.	Fresh	Fresh	Light	Clear	Clear	Clear	do	do	Ebb	Flood.
10[1]	38	50	44	42	43	43	...	...	...	NE.	NE.	N.	Light	Light	do	Cloudy	Cloudy	Cloudy	do	do	Flood	Ebb.
11[6]	40	38	42	42	42	42	...	...	...	SE.	SW.	SW.	do	Strong	Fresh	Clear	do	do	do	do	do	Do.
12[1]	43	48	46	41	41	41	...	...	...	SW.	W.	NW.	Fresh	Fresh	do	do	Clear	Clear	do	do	do	Do.
13[1]	38	50	40	41	41	41	...	...	...	W.	NW.	NW.	Light	Light	Strong	Cloudy	Cloudy	do	do	do	Ebb	Flood.
14[1]	34	49	48	40	41	41	...	...	...	NW.	NW.	N.	Strong	Strong	Light	Clear	Clear	do	do	do	do	Do.
15[7]	42	48	47	41	41	42	...	...	...	E.	S.	.....	Light	Light	Calm	Cloudy	Cloudy	Cloudy	do	Flood	do	Do.
16[8]	41	54	55	42	44	44	...	...	...	NE.	SE.	NW.	do	do	Light	do	Clear	Clear	Clear	do	do	Do.
17	44	56	52	44	46	46	...	...	...	NE.	SW.	SW.	do	do	do	do	Cloudy	Cloudy	do	do	do	Do.
18	46	60	54	46	47	49	...	...	...	NE.	SE.	SE.	Fresh	do	Fresh	do	Clear	do	do	do	do	Do.
19	42	62	58	47	50	53	...	...	...	NE.	.....	S.	Light	Calm	Light	Clear	do	Clear	do	do	do	Do.
20	51	61	64	50	54	54	...	...	...	.....	SW.	SW.	Calm	Fresh	do	do	do	do	do	Ebb	Flood	Ebb.
21[9]	52	66	63	53	58	57	...	...	59	.....	SE.	.....	do	Light	Calm	do	do	do	do	do	do	Do.
22	61	72	80	55	58	64	60	60	60	NE.	SE.	.....	Light	do	do	do	do	do	do	do	do	Do.
23	60	78	75	58	60	62	60	61	63	NE.	.....	S.	do	Calm	Light	do	do	do	do	do	do	Do.
24	60	74	69	60	60	63	61	62	64	SE.	.....	WSW.	do	do	do	Cloudy	do	Cloudy	do	do	do	Do.
25	64	74	67	61	62	63	62	63	64	NE.	N.	SE.	Fresh	Light	do	do	do	do	do	do	do	Do.
26[10]	56	60	59	60	60	60	60	60	60	SE.	NE.	NE.	Strong	do	Fresh	do	Cloudy	do	Muddy	do	Ebb	Flood
27	59	69	68	58	60	61	59	60	61	W.	WNW	W.	Fresh	Fresh	Light	Clear	Clear	Clear	do	do	do	Do.
28[11]	59	64	58	60	60	60	60	60	60	E.	SE.	S.	do	do	Strong	Cloudy	Cloudy	Cloudy	do	Flood	do	Do.
29[12]	44	58	58	58	58	56	58	58	56	NW.	NW.	NW.	Violent	Storm	Light	Clear	do	Clear	do	do	do	Do.
30	58	66	68	54	56	57	54	56	58	W.	W.	SW.	Light	Light	do	do	Clear	do	do	do	do	Do.
May 1	58	54	50	56	56	55	56	56	55	NE	NE.	NE.	Light	Fresh	Fresh	Cloudy	Cloudy	Cloudy	Muddy	Flood	Ebb	Flood.
2	52	68	57	53	56	55	53	56	55	NW.	NW.	NW.	Fresh	Strong	do	Clear	do	Clear	do	do	High	Ebb.
3[13]	64	68	58	54	54	55	54	54	55	NW.	NW.	SW.	Light	do	do	do	do	Cloudy	do	do	Flood	Do.
4	51	64	61	53	54	56	53	54	57	N.	W.	NW.	do	Light	do	Cloudy	do	do	Clear	do	do	Do.
5	52	72	70	54	57	57	55	57	58	NE.	S.	.....	do	do	Calm	do	Clear	Clear	do	Ebb	do	Do.

3[14]	58	76	68	58	61	60	58	60	59	NE.	SW.	SW.	...do	...do	Fresh	...do	...do	Cloudy	...do	.. do	...do	Do.
7[15]	58	60	59	59	59	60	59	59	59	NE.	NE.	N.	Strong	Strong	...do	...do	Cloudy	...do	Muddy	.. do	.. do	Do.
8	56	61	62	59	59	60	59	59	60	NE.	SE.	NW.	Light	Light	Light	...do	...do	Clear	...do	...do	...do	Do.
9[16]	50	68	68	56	58	60	57	58	60	SW.	S.	NW.	Fresh	do	Strong	do	Clear	Cloudy	...do	...do	...do	Do.
10	56	60	59	58	60	60	58	60	60	NW.	NW.	NW.	.. do	Fresh	Fresh	Clear	Cloudy	.. do	...do	Clear	Flood	Ebb	Flood.
11	51	56	60	56	57	57	56	57	57	NW.	NW.	SW.	.. do	Strong	Light	...do	...do	...do	Clear	Flood	Ebb	Do.
12	67	68	67	57	57	57	57	57	57	.....	SW.	NE.	Calm	Light	Fresh	...do	...do	...do	...do	Muddy	...do	Do.
13[17]	54	55	54	57	57	57	57	54	57	SE.	NE.	NW.	Fresh	Fresh	Light	Cloudy	...do	...do	...do	Muddy	...do	Do.
14[18]	53	68	62	57	58	58	57	58	58	NW.	NW.	.....	...do	Light	Calm	...do	...do	...do	...do	...do	...do	Do.
15	70	76	73	57	58	61	57	58	61	NW.	NW.	SE.	...do	.. do	Fresh	Clear	Clear	Clear	Clear	...do	...do	Do.
16	76	78	72	58	61	62	58	61	62	NW.	NE.	E.	Light	Fresh	Light	...do	.. do	.. do	Clear	...do	...do	Do.
17	64	70	64	60	62	62	60	62	62	SE.	SE.	.....	...do	Light	Calm	...do	Cloudy	Cloudy	...do	...do	...do	Ebb.
18	66	72	67	61	62	62	61	62	62	SW.	SW.	SW.	...do	Fresh	Fresh	...do	Clear	...do	...do	Ebb	Flood	Do.
19	65	70	69	60	61	61	60	61	61	W.	SW.	SE.	...do	Light	...do	...do	...do	Clear	...do	...do	...do	Do.
20	70	75	72	61	62	62	61	62	62	SW.	SW.	SE.	...do	Fresh	...do	...do	Cloudy	Cloudy	...do	...do	...do	Do.
21[19]	67	71	67	62	62	62	62	62	62	SW.	SE.	SE.	.. do	...do	do	Cloudy	.. do	.. do	...do	...do	...do	Do.
22[17]	72	69	67	68	68	68	68	68	68	NE.	NE.	SE.	Fresh	.. do	Light	...do	...do	Clear	Clear	do	.. do	...do	Do.
23[20]	60	70	72	67	69	72	67	69	72	NE.	SE.	S.	Light	Light	...do	...do	...do	Clear	Clear	do	.. do	...do	Flood.
24	61	62	60	68	68	68	68	68	68	E.	E.	NE.	Fresh	Fresh	...do	...do	...do	Cloudy	...do	...do	.. do	...do	Do.
25[21]	59	67	69	66	66	67	66	66	67	NE.	SE.	SW.	...do	Light	...do	...do	...do	Clear	.. do	.. do	Flood	Ebb	Do.
26[18]	65	72	72	68	68	70	68	68	70	NE.	NE.	NE.	Light	.. do	...do	...do	...do	Cloudy	...do	...do	...do	.. do	Do.
27[22]	70	72	70	68	68	68	68	68	68	NW.	NW.	NE.	.. do	Fresh	...do	...do	...do	Cloudy	...do	...do	...do	...do	Do.
28	67	69	68	68	68	68	68	68	68	NE.	NE.	NE.	Fresh	...do	Fresh	...do	Clear	Clear	Clear	...do	...do	...do	Do.
29[23]	58	62	58	67	67	65	67	67	65	NE.	NE.	NE.	.. do	...do	do	...do	Cloudy	Cloudy	...do	...do	...do	...do	Do.
30[24]	60	61	64	63	63	65	63	63	65	NE.	.....	N.	...do	Calm	...do	...do	.. do	...do	...do	...do	...do	Flood	Ebb.
31[25]	68	71	68	64	66	66	64	66	66	NE.	SW.	SE.	Light	Light	Light	do	...do	...do	...do	...do	Ebb	...do	Do.
June 1	69	71	70	65	67	67	65	67	67	NW.	NW.	W.	...do	Fresh	do	Clear	...do	...do	...do	...do	...do	...do	Do.
2	68	70	73	66	68	69	66	68	69	NW.	NW.	N.	...do	Light	do	...do	Clear	Clear	Muddy	...do	...do	...do	Do.
3	69	70	72	67	68	70	67	68	70	NE.	SE.	.....	...do	...do	Calm	...do	...do	...do	...do	...do	...do	...do	Do.
4[26]	69	70	72	68	69	70	68	69	70	SE.	.....	.....	...do	Calm	...do	...do	...do	Cloudy	...do	...do	...do	...do	Do.
5	72	76	70	70	70	70	70	70	70	SW.	SW.	SW.	Fresh	Fresh	Fresh	...do	...do	Clear	Clear	...do	...do	...do	Do.
6	70	69	71	68	70	70	68	70	70	NW.	SE.	S.	.. do	Light	Light	...do	...do	...do	...do	.. do	...do	...do	Do.
7	68	74	76	70	72	73	70	72	73	SW.	SW.	SW	.. do	Fresh	Fresh	...do	...do	...do	...do	...do	...do	...do	Do.
8	75	77	76	72	73	73	72	73	73	NW.	SW.	SW.	Light	Light	...do	...do	...do	...do	...do	...do	...do	Ebb	Flood.
9	64	67	69	68	68	72	68	68	72	NW.	NW.	NW.	Fresh	Fresh	do	Cloudy	Cloudy	Cloudy	...do	Flood	...do	...do	Do.
10	67	71	69	68	70	71	68	70	71	NE.	.....	SE.	Light	Calm	Light	...do	Clear	...do	...do	...do	...do	...do	Do.
11[27]	69	.....	.....	72	.....	.....	72	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	

[3] Current in river.
[2] River full of floating ice.
[3] Rained all night from NE. Rain stopped at 10 a. m.
[4] Rain from 4 p. m. to 10 p. m.; from 4 a. m. to 5 a. m.
[5] Current in river and very low tide.
[6] Rain and snow 11.30 a. m.; stopped snowing 2 p. m.; stopped raining at 6 p. m.
[7] Rain in afternoon; current in river.
[8] Slight current in river.
[9] First eggs for season to-day.
[10] Thunder storm from 3 to 7 a. m.
[11] Rain 12.45 p. m.; stopped 5 p. m.
[12] Tide very low; water muddy.
[13] Light rain 7 to 8 p. m.
[14] Rain at 9 30 p. m.
[15] Rain all day; stopped 11 p. m.
[16] Rain squall from northwest 6 p. m.
[17] Rain all day.
[18] Rain stopped 2 a. m.
[19] Rain 8 p. m.
[20] Rain stopped 5 a. m.
[21] Rain 11.50 p. m.
[22] Rain 9 a. m.; stopped 1 p. m.
[23] Rain all night.
[24] Rain stopped 11 a. m.
[25] Rain 3 p. m.; stopped 6 p. m.
[26] Rain from 4.30 p. m. to 6.15 p. m.
[27] Ceased operation in hatching-house at 9 a. m.

TABLE III.—*Record of distribution of shad fry made from April 30 to June 11, 1885, by Battery Station, Maryland.*

Date.		Number of fish.		State.	Place.	Stream.
		Originally taken.	Actually planted.			
	1885.					
Thursday..	April 30	85,000	85,000	Maryland.....	Battery Station[1].	Susquehanna River.
Wednesday	May 6	300,000	.....	Pennsylvania.	Harrisburg[2]	Do.
Sunday.....	May 10	473,000	473,000	Maryland.....	Battery Station[3].	Do.
Tuesday...	May 12	260,000	260,000[6]	Alabama	Montgomery....	Alabama River.
Thursday..	May 14	506,000	506,000	Maryland.....	Battery Station[3].	Susquehanna River.
Sunday....	May 17	245,000	....do		....do[4].....	Do.
Monday ...	May 18	56,000	56,000	....do	....do[4].....	Do.
Wednesday	May 20	440,000	440,000	....do	....do[4].....	Do.
Thursday..	May 21	573,000	573,000	....do	....do[3].....	Do.
Thursday..	May 21	1,250,000	1,250,000[7]	New York....	Mechanicsville .	Hudson River.
Friday.....	May 22	300,000	300,000	Maryland.....	Battery Station[3].	Susquehanna River.
Saturday ..	May 23	674,000	674,000	....do	....do[3].....	Do.
Sunday....	May 24	500,000	500,000	....do	....do[3].....	Do.
Sunday....	May 24	1,500,000	1,500,000[7]	Virginia.....	Danville.....	Dan River.
Monday ...	May 25	125,000	125,000	Maryland.....	Battery Station[3].	Susquehanna River.
Tuesday...	May 26	150,000	150,000	....do	....do[3].....	Do.
Wednesday	May 27	100,000	100,000	....do	....do[3].....	Do.
Wednesday	May 27	250,000	250,000	....do	North East[2].....	North East River.
Thursday..	May 28	250,000	250,000	....do	Railroad crossing.[2]	Gunpowder.
Saturday ..	May 30	250,000	250,000	....do	Relay House[2] ...	Patapsco River.
Monday ...	June 1	251,000	251,000	....do	Elkton[2]	Elk River.
Wednesday	June 3	270,000	270,000	....do	.....	Chester River.[2]
Friday.....	June 5	200,000	200,000	....do	Bush Station ..	Bush River.[2]
Saturday ..	June 6	158,000	158,000	....do	Battery Station[5].	Susquehanna River.
Saturday ..	June 6	500,000	500,000	Pennsylvania.	Sunbury[2]	Do.
Tuesday ..	June 9	400,000	400,000	.....	..... [2]	
Wednesday	June 10	601,000	601,000	Maryland.....	Battery Station[5].	Susquehanna River.
Thursday..	June 11	33,000	33,000	....do	....do[5].....	Do.
Thursday..	June 11	25,000	25,000*	... do	....do[5].....	Do.
Total ..	.....	10,725,000				

[1] By William Hamlen.
[2] By F. L. Donnelly.
[3] By Sauerhoff & Tolbert.
[4] By G. H. Tolbert.
[5] By W. P. Sauerhoff.
[6] Delivered to N. Simmons.
[7] Delivered to car No. 3.
* This deposit was of eggs almost on the point of hatching.

135.—SALTING ROE IN NORWAY.*

Roe did not become an article of commerce in Norway until the second half of the seventeenth century. About the year 1650 the quantity of roe annually exported from Bergen was only 9 barrels, and from Trondhjem in 1665, about 200 barrels. At the close of the seventeenth century Bergen annually exported 800 barrels, Christiansund 100, and Trondhjem 700. About the middle of the eighteenth century the quantity of roe exported from Norway had increased to 8,000 barrels per year, and toward the end of the century to nearly 13,000 barrels. From 1830 to 1850 it was a little above 20,000; from 1851 to 1865, about 30,000, and from 1866 to 1875, about 40,000 barrels annually. Since then it has risen to 50,000, and in 1880 to 70,000 barrels. On an average since the middle of the last century one barrel of roe has been exported annually to a thousand kilograms of fish.

*"*Salting of Roe.*" From the *Norsk Fiskeritidende*, vol. iv, No. 1, Bergen, January, 1885. Translated from the Danish by HERMAN JACOBSON.

The roe trade is somewhat of a hazard. We have but few competitors in the world's markets, as five-sixths of the 60,000 barrels of roe which were brought to market came from Norway. The market, however, is limited, and insignificent changes in the supply or demand will influence the price. There is no product of the fisheries which varies so much in price as roe; thus, the price of roe at the Loffoden Islands has varied from $3.75 to $12.33 per barrel during the period from 1860 to 1884.

To buy roe requires a certain degree of experience. As roe is a costly article, the aim of the seller frequently seems to be to make it go as far as possible. Positive frauds are perpetrated by mixing with the roe of the common cod (*Gadus morrhua*) the less valuable roe of the pollock (*Gadus virens*),* or by placing in the middle of the barrel salt, pieces of ice, soft roe, empty roe-bags, fish-heads, and entrails, and good roe at the top and bottom. As such frauds have occurred, people who buy roe should be on their guard. If a person who buys roe has no chance to examine the contents of the barrels, and buys of people whom he does not know, or who are not trustworthy, it is a good plan to cause the seller to brand the barrel with his mark, as frauds are likely to be detected when the roe is repacked for shipping, although the inconvenience occasioned thereby will frequently be greater than the loss. Other means, not exactly unlawful but objectionable, are also employed to give the barrel the appearance of being full. Such attempts at fraud will be made as long as there are buyers to whom roe can be sold to advantage, and as long as there are persons who have not yet found out that the best and most profitable results are obtained by careful treatment of the roe. We shall have occasion again to speak of these tricks of the trade.

In cutting open the fish care should be taken not to injure the roe-bag, as in opening the fish the knife is very apt to cut the roe. The person who takes out the roe should also be careful not to remove at the same time portions of the entrails, as is sometimes done. The tubs in which the roe is gathered should have holes through which the water can run off, as thereby salt is saved and a better article of roe is obtained. Whenever it is possible to let the roe stand for half a day, so that the water can all flow out, this should not be neglected. Roe would better be salted in perforated barrels so that the brine can run off freely, as the brine makes the roe soft and less liable to keep. Generally twelve holes are made in the sides of the barrel, and four in the bottom. If roe is to be laid in brine† either it should be put in perforated tubs and salt sprinkled over it, or it should be dry-salted for from eight to fourteen days before it is put up in tight barrels.

* The grains of roe of the *Gadus virens* are, as a rule, more pointed and of unequal length. This roe also has a dark color, and becomes darker with age.

† Roe laid in brine, of which formerly a good deal was used on the south coast of France, finds scarcely any sale at present.

Thirty kilograms of salt is considered a sufficient quantity for one barrel of roe. As regards the kind of salt to be used, it will depend how soon one desires the roe to become salted. A regulation of September 12, 1753, prescribed that only French salt should be used, and St. Ives salt was positively prohibited. At the present time, however, medium coarse-grained salt is preferred, especially Cadiz salt, and also St. Ives or fine Lisbon salt. Coarse salt should not be used, as the coarse grains are apt to spoil the looks of the roe-bag, by becoming imbedded in it, and give it a burnt look. While the roe is being salted it should not be pressed. When, after a week's time, it has settled somewhat, the barrel is filled, previously salted roe of the same quality being put at the bottom. It is then closed, so as to prevent the air from affecting it, and is put in a dry place. The barrel should be laid on its side, as otherwise the lower layers are subjected to too great a pressure. For the same reason, it should be turned from time to time. While the roe is salted and is settling it should not be exposed to frost, but after the roe has absorbed the necessary quantity of salt, it can stand much cold before it freezes. Nothing but firm roe should be used for salting. Roe which is almost ready for spawning, soft roe, and roe from fish which have lain some time or which are spoiled, as well as roe-bags which have been half emptied, should, if used at all, be salted separately. Every salter should be very careful in sorting the roe. Badly sorted roe always awakens suspicion, and will, as a rule, bring a lower price than it deserves, while roe which has been well sorted during salting becomes more valuable from the mere fact that it will keep better, so that when it is to be repacked for shipping it need not all be taken apart. The number of roe-bags in a barrel varies greatly. If the roe is of prime quality it can vary between 200 and 400; on an average, however, the number is 300, or somewhat less.

Many people salt the roe in boxes and afterwards transfer to barrels. This method does not improve the quality of the article, if the roe is firm. It requires more salt and labor, exposes the roe to the effects of frost and air, which exposure is apt to make it dry and hard, and there is likewise danger of its being broken too much during this treatment. If care is not exercised in the use of salt when the roe is transferred to the barrels, it is apt to become "salt-burned." Roe which has been salted too much is hard and dry, loses its natural pale-red color, and becomes dark and brittle. If the roe is loose, salting it again will give it greater consistency. If properly treated, even soft roe will make a first-class article. This is done by salting it as soon as it is taken from the fish, by using more salt than for the firm roe, or by salting it a second time, when care, however, must be taken not to use too much salt. Occasionally it may become necessary to salt roe in boxes, because this affords more space, but more frequently the reason is that when it is resalted the volume is increased, partly by the salt which is employed and partly because it does not have time to settle sufficiently before it is

sold. The difference between the contents of a barrel which has been resalted and one where this has not been done is often as much as 30 per cent, 12 per cent of which is caused by the salt. Before the roe is shipped it should, therefore, be allowed to stand and settle for a week. We must not fail to mention that the temptation is very great, and in most cases irresistible, to mix inferior roe with the good during the repacking. Every buyer of roe should therefore be on his guard when he buys roe which has been repacked, and examine not only its quantity and quality, but also whether it has been salted too much. Roe salted in boxes is never as valuable as roe salted in barrels, even if the raw material was the same. When salted in barrels it settles so firmly that all air is excluded, while there will always be more or less air between the layers if the roe has already reached a certain degree of stiffness before it is put into the barrels. Roe put up in barrels to begin with will therefore keep much better than roe which has been repacked, and will for this reason alone be more valuable.

Some people are in the habit of laying the roe in snow and of not salting it until it is to be sold, which custom is very objectionable. When under the snow, water penetrates the roe and freezes, so that for a little while it retains an artificial firmness. But the advantage to the seller is only an imaginary one, as only very inexperienced buyers will be deceived thereby. On the other hand, the seller runs the risk of losing a good deal, as roe put under the snow is apt to turn sour and lose its value. Sour roe, when salted, becomes brittle and is apt to crumble to pieces during the process. It can be detected at once by its odor. The Loffoden fishery law of July 1, 1816, and the Finmark fishery law of September 13, 1830 (which last-mentioned law is still in force, although it is of little practical value), prohibited the putting of roe under the snow for more than twenty-four hours before salting. As far as the Loffoden Islands are concerned, the law is no longer in force, and it is considered very objectionable to put roe under the snow.

Fresh roe freezes when the temperature is two or three degrees below zero (Réaumur). In frosty weather the tubs with roe should, therefore, be protected against the cold, either by covering them or by placing them in a closed shed; and the salting should begin before the roe commences to spoil. Frozen roe should never be salted, as the salt melts before the roe is entirely thawed out, and a great portion of it is therefore not exposed to the influence of the salt. If, as may happen, it freezes without any fault of the salter, it should for some time be laid in salt water, or, still better, in brine, before it is salted. It is not advisable to defer the salting until milder weather sets in, and the roe thaws of itself, as this will generally tend to make it sour. Nor should it be laid in snow for the purpose of thawing it, unless it can be salted within a couple of days.

In order to make a certain quantity of roe go a long way, it is in some places salted in a mild brine, whereby it retains more water than

if it had been salted in salt, as the salt diminishes the quantity of water in proportion to the quantity of salt used. When salted in mild brine, the roe, if allowed to stand too long, begins to ferment. When such roe is to be sold, it is packed into a barrel, if brine roe is asked for, or it is put in a perforated barrel if the buyer wants dry-salted roe. Such roe can always be recognized by its being soft. It takes it a longer time to settle completely, and decay may have set in, without any noticeable indications. Roe salted in brine, which is afterwards to be dry salted, very soon becomes dark and brittle. Buyers should therefore be careful not to be imposed upon by such an article, which ought never to be prepared.

Referring to the above, we must consider as not advisable:

(1) To thaw roe in snow, or during mild weather.

(2) To salt roe in boxes.

(3) To use coarse salt.

(4) To use too much salt.

(5) To expose the roe to frost before it has absorbed a sufficient quantity of salt.

On the other hand we recommend:

(1) To let the water run off before the salting begins.

(2) When there is frost, to salt the roe as soon as possible, or in case it should already be frozen, to thaw it in salt water or brine.

(3) To use the dry-salting method.

(4) To salt the roe in barrels.

(5) To use Cadiz, St. Ives, or fine Lisbon salt.

(6) To fill up the barrels as soon as the roe has sufficiently settled, and then to close the barrels at once.

(7) To let the barrels lie for a while after they have been closed.

(8) To be very careful in sorting the roe.

(9) To use more salt for loose roe, or to salt it a second time.

As altogether objectionable we must mention:

(1) To keep roe in snow for a considerable length of time.

(2) To salt frozen roe.

(3) To salt the roe first in brine and afterwards in dry salt.

In sorting roe the following three sorts should be distinguished:

First quality, full and perfect roe.

Second quality, torn, frozen, or salt-burned roe, or roe some of which has been lost by spawning.

Third quality, roe of which there is hardly anything but the bags, and sour roe.

All roe is turned when it is to be shipped; and when this is done it will be found difficult in well-sorted roe to separate the different bags. Very little salt is used (about two or three barrels to one hundred barrels of roe), and this especially at the bottom of the barrel. In France this latter process is omitted.

136.—PORPOISE PRODUCTS.

By GEORGE L. SPARKS.

I forward to you to-day a box containing samples of porpoise products in the line of meats and sausage manufactured from the flesh of the porpoise. As far as I can learn, this is the first attempt ever made to utilize the product in this shape. I shall be able shortly to produce a superior article to what you will receive. This present stock was manufactured from flesh that had remained in salt for several weeks, owing to the difficulty in transporting, curing, smoking, &c., a new article. If I meet with any encouragement with the product commercially, I will erect the necessary buildings, machinery, and work the product up fresh on the ground. Our fishery is located at Hatteras, N. C., which we have secured by contract and purchase for a number of years. So far this season we have captured some 600 porpoises. If the weather had been favorable, with our appliances, we should have obtained about 2,000. This we expect will be the total for the season. I am considering the matter of sending some of the product to the New Orleans Exposition. We have sold some of the meat, but not as porpoise flesh, there being a certain amount of prejudice against eating it as such. However, I believe when properly brought out, that can be overcome. We are producing a very superior oil from the body and jaw; also an excellent article of leather, of our own tanning. The business being comparatively a new one to this part of the world, we experience considerable difficulty in making a market, especially with the meat product. I believe that in destroying the porpoise we are doing for all engaged in the fishing industry a great service. We have expended a large sum in learning the best way to capture and utilize this animal, and we believe we shall be successful. There was a porpoise fishing company at Cape May, N. J., which during its existence of some two years succeeded in capturing about 120 porpoises.

340 SOUTH FRONT STREET,
Philadelphia, Pa., February 19, 1885.

The following item from the Scientific American may be of interest in this connection:

Porpoise fishing for the oil alone has been carried on many years off the North Carolina coast. The process of rendering the oil is very simple, and the average amount obtained is from 6 to 8 gallons. The experiment made last summer by the Cape May company proved successful, $3,740 being realized, it is said, from an outlay of $1,000 in five weeks' fishing, and its facilities for taking porpoises will be greatly increased the coming season. The skin of the porpoise makes a very superior, soft, and pliable leather, and the estimated value of each individual for its oil and skin alone is placed at $20. Last autumn it was discovered that the flesh made rather a savory dish, and it became so popular at the fashionable watering-places along the

coast that a Philadelphia firm recently made a proposition to take all that may be caught along the coast this season, with the view of working much of it into mince-meat. The Cape May company, it is said, will reject the offer, as it already has offers from prominent Philadelphia and New York hotels and restaurants, and it is believed that there will be a demand for the meat which cannot be met. The meat is red and juicy, and resembles in appearance beef, but is more solid, finer-grained, and very tender; much more like venison, which it resembles in flavor. They are taken in seines about 1,000 feet long and very wide, and when captured, if not already drowned, are killed by stabbing with knives. It would seem that the outlook for the success of a new and valuable industry being established along our coast is most excellent.

137.—ANSWERS TO QUESTIONS ABOUT FATTENING OYSTERS.*

By JOHN A. RYDER.

(1) Oysters are not usually "fed" for market; they are sometimes taken from their original bed and carried to the "floats," where fresher water is allowed access to them. Absolutely fresh water would kill them. The fresher water is absorbed in quantity, and gives them an appearance of plumpness.

(2) In such a case they are piled up in mass on the float, but this will not matter; they may be scattered thinly over the float or on a bottom where somewhat fresher water reaches them.

(3) Oysters can be "water-swollen" in this way in twenty-four hours. It is a trick of dealers, resorted to to make their oysters more salable.

(4) The natural food of the oyster is small or very minute animals and plants belonging to widely different orders and classes, plants mainly, however, known as *diatoms*.

(5) There is no ready-made preparation put up for the purpose of feeding oysters. If there is it may be pronounced a humbug. I have heard of corn-meal being used, and some of it would doubtless be digested by the animals, but the way in which I have always heard of its being used is exceedingly wasteful, and the amount actually ingested by the animals as food during the short time they are fed is quite insignificant.

These matters have been somewhat fully discussed in papers by the writer of this, and published in the reports of the Commission, Census, and Geological Survey.

WASHINGTON, D. C., *December* 24, 1884.

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* Writing from Biloxi, Miss., December 17, 1884, Mr. John E. Morrison made the following inquiries:

(1) Are oysters placed in fresh, salt, or brackish water preparatory to being fed?

(2) Are they scattered singly in the water or piled up promiscuously?

(3) What length of time does it generally take to fatten them?

(4) What is the best food for oysters?

(5) Is there any preparation put up for feeding oysters, or is corn-meal the best for them?

Vol. V, No. 27. Washington, D. C. Sept. 29, 1885.

138.—SMOKING HERRING IN DENMARK.*

By AUG. GARDE.

Mr. P. Gräsböll, the representative of the Danish Fishery Association in Bjerget, under date of July 21, 1884, called the attention of the board of directors to the circumstance that, while formerly the chimneys of the houses in his neighborhood were built in such a manner as to inclose below the entire cooking-place, which made them resemble a funnel placed upside down and fitted them in a special manner for fish-smoking, they are now nearly everywhere replaced by ranges with so-called closed chimneys, which fact renders it impossible to smoke fish in them. The fishermen, therefore, are no longer able to smoke those fish which they cannot sell, and thus preserve them for their own use, which was often done when (especially in summer) unusually large quantities of mackerel and other fish had been caught. Mr. Gräsböll, therefore, thinks that in his neighborhood there is great need for small smoke-houses, either for one family or for several which go in partnership, and desires information as to how such smoke-houses, especially those for several families, can be constructed in the best and cheapest manner.

Inquiries regarding the establishment and management of smoke-houses, which have reached us from other parts of the country, seem to indicate that there is an unusual desire to preserve fish in this manner; and as smoked fish generally find a ready market, especially when experience has taught how to treat the fish so as to suit the tastes of the different consumers; and considering that it is best not to make the establishments too large in the beginning, but so that they can be gradually enlarged as occasion demands, Lieutenant Trolle has gathered information from different smoke-houses throughout the country. On the basis of his observations and some reports from Norway, he has prepared the following description, which is published in the *Fiskeritidende* in the hope that it will attract more general attention and produce some beneficial results:

There are two methods of smoking, namely, cold-smoking and hot-smoking. Which of these two methods is to be employed depends on the market for which the fish are intended, and on the length of time the fish are intended to be kept. These two different methods produce different articles. Cold-smoking produces smoked salt fish, as prior to

*From *Fiskeritidende*, No. 41. Copenhagen, October 7, 1884. Translated from the Danish by HERMAN JACOBSON.

the smoking the fish has been in brine for some time; while hot-smoking produces a fresh smoked and cooked fish, which is salted very little, and in which the flavor of salt can scarcely be discerned.

In America, England, Holland, and Russia cold-smoking is generally employed for herring, salmon, haddock, and halibut. In Germany and in some parts of Sweden this method is employed only for salmon. As far as is known, hot-smoking is used in Germany, Sweden, and Denmark for all other fish.

As a general rule, an old-fashioned open chimney can be used for hot-smoking by arranging the poles on which the fish are hung 3 or 4 feet above the fireplace. These chimneys, however, have nearly everywhere gone out of fashion; and for this reason the arrangement of the common Danish smoke-houses will be described.

The following description of a smoke-house on the island of Thurö, near Svendborg, is given by the owner, Chr. Julius Nielsen:

"The house has strong fireproof walls; its length is 12 and its breadth 8 yards. One-half is occupied by the packing-room and office, and the other half forms a single room with a concrete floor. At the gable-end there is a chimney in which the fish are smoked. This chimney is 17 yards high and 4 yards square, and along its entire height is divided by a wall into two smoke-rooms. In each of these, two rows of herring can be hung, each row containing 850 large herring; but as a general rule, in order to prevent the fat from dripping from the upper upon the lower, only one row is suspended. For smoking, beech or oak is used, split fine in pieces about a yard long, or oak or beech shavings from shipyards; but common shavings are not so good. The expense of smoking and packing is about 8 cents per 80 herring. Below the chimney has two iron doors, one for each smoke-room."

The following description of a smoke-house at Masnedsund is given by the owner, P. H. Löhmann:

"The oven, with the fireplace below, is 6 feet broad, 5½ feet high, and 3 feet deep. In front there are iron doors. There is room in the oven for three rows of poles; the distance from the fire to the lowest row is 3½ feet, and the distance between the rows 14 inches. At the top the oven can be closed by a lid, which opens outside, toward the back wall of the chimney. The chimney projects about a foot beyond the front of the oven, and therefore forms an opening for the escape of the superfluous smoke. The oven is about 6 feet high, and grows narrower toward the top, which is about 1 foot in diameter. The chimney is held together by a strong iron bar. When the fish have been dried in the air, smoking may be done on all three irons, therefore in three rows. The lid at the top is then kept closed. If, however, the oven is to be used for drying, the two upper rows are used for this purpose; and in that case the lid must remain open, and the opening is covered by bags or pieces of board. Gradually, as the two lower rows have been smoked, the two upper ones are put a row further down, and a new row is hung

on the upper iron. The best materials for smoking are pieces of beech wood or alder shavings; and in case of necessity, beech and oak shavings can be used. It should be stated, however, that oak is apt to impart a bitter flavor to the fish."

The two ovens described above are exceedingly practical and economical, and are more to be recommended than the so-called Flensborg and Ellerbek ovens.

A larger smoke-house in Svanike, on the island of Bornholm, is about 18 yards square and 4 yards high, while the chimney is 6 feet high and 4 feet broad. There are seven smoke-rooms, or ovens, for hot-smoking, and one for cold-smoking. The herring are hung in pairs over poles 3 feet long, one herring's head being stuck through the gills of the other and coming out at the mouth. If necessary, a thin stick of wood serves as a skewer. On each pole about 40 herring can be hung, which must not touch each other. The poles are arranged crosswise over square frames, 3 feet broad and 7 feet long, which are run into the oven on ledges. Each frame contains 26 poles, and about 1,040 herring can be smoked in it at the same time. The entire smoke-house can contain 22,400 herring, which are smoked by the hot method. The lowest frame is about 3 feet above the fireplace. In the cold-smoke chimney about 12,000 herring can be smoked. The fuel used is alder-wood, which is moistened a little so as to make more smoke, and oak and beech sawdust so as to keep the flames down when they blaze up too high. The price of sawdust is about 52 crowns [about $14] per load at Hilleröd, in Seeland. It is shipped from Copenhagen to Bornholm in sacks containing 40 pounds each. The total freight per 100 pounds is 15 cents. Alder-wood costs $4.55 per cord. The quantity of fuel used for smoking 8,000 herring is about one-quarter cord of wood and one sack of sawdust.

The herring are smoked either cleaned or whole. In the first case they are cleaned, washed in fresh water, and then laid in strong salt brine for about half an hour. For the Danish market the herring are considered to be sufficiently penetrated by the salt brine when a small black spot appears in the eyeball, which at first became white when the fish were put in the brine. The herring are then dried (hung up on frames), if possible in the open air; but when the air is moist they are dried on the upper frames in the oven. The last-mentioned method takes from one-quarter to one hour. When the hot-smoking method is employed, herring are thoroughly smoked in from one and one-half to three hours, and in the cold method in about seven hours. The work in this smoke-house generally occupies twelve or fourteen women. The wages are 2½ cents per hour. One woman is needed to attend to each oven, the others are engaged in cleaning, salting, hanging, and packing the herring. Care should be taken that the oven is well heated and dried before the fish are hung in it, as the development of steam is apt to injure the fish. It requires some practice to attend to such an oven. The principle of hot-smoking is simply this, that the herring are cooked

and smoked at the same time. Until the fish are thoroughly dry, if this has not been obtained by their hanging in the open air, the smoke should not be too strong, and the lid should be kept open. The process is longer or shorter, according to the use of strong and hot smoke, which produces a better cooked but less durable article, or of weak and cooler smoke, which makes the fish keep longer. Before the fish are packed, they must be cooled off slowly. The larger the fish and the more water it contains, the more difficult it will be to smoke it by the hot process, which at any rate should be employed only after the fish has been pressed, as otherwise it easily falls to pieces.

We have received the following report of a smoke-house in Holbek, owned by Clausen Brothers:

"The smoke-house has four ovens, built from time to time as the demands of the trade required. From 16,000 to 24,000 herring can be smoked per day. In one of the three large ovens 1,600 herring can be smoked at the same time.

"The chimney itself should not be less on the inside than 1 yard square, as otherwise it is not capable of receiving the steam from the fish when they are dried in the oven. The top should be covered with a thin plate of cast iron, so that the rain cannot fall on the fish. For supporting the front part of the oven it is best and cheapest to use an old iron rail; any other bar will scarcely be strong enough. The oven can easily be only half the size of one of the larger ones, but the larger it is the more profitable it will be as regards the quantity of fuel consumed. In front of the oven iron plates are hung on an iron pipe, and these plates are taken off when shavings are put on the fire. From these plates and up to the iron bar the opening is covered by a piece of linen cloth, as it is necessary to look into the oven frequently in order to see that the flames do not rise too high and burn the tails of the fish. If this should be the case the flames must at once be quenched by moist sawdust. The fuel used is exclusively oak and beech shavings, particularly from coopers who make large barrels, as the shavings must not be too fine; beech and oak sawdust are also used, but shavings and sawdust of pine-wood should never be employed, as it is apt to give to the fish a resinous flavor. As soon as the herring are brought in from the boat they are placed in a strong brine for three or four hours, or they are left over night in a weaker brine. Some people also use the dry-salting method. The fish are then washed and strung on round wooden sticks, three-fourths of an inch thick and 3 feet long. This stick is stuck through the gills and comes out at the mouth. According to the size, from 18 to 21 fish are strung on every stick, always in such a manner as not to touch each other. They are then hung in the open air and dried in the sunshine, if possible, and then put in the oven for smoking. The smoking process may take from three to six hours, according to the drying which the fish have undergone in the air. After the fish have been smoked they are generally allowed

to hang one night to cool off, and are in the morning packed in boxes holding 80 fish each."

In establishing a small smoke-house it will be sufficient to build about 8 yards of the west end with two ovens and make the house a little broader. The western chimney will then come to stand above the oven. The floor of the smoke-house should be solid, and it is best to have it made of concrete. First a bed of common stones about as large as a hand is made and well rammed down; and on the top of this, mortar (one part Portland cement and two parts gravel) is spread.

We give in conclusion a description of a haddock smoke-house in Grimsby, England, where the cold-smoking method is employed. The chimneys go through the entire building, and have only one door below and a window at the top. These chimneys are deeper than they are broad. They should not be too broad for a man to span them with his legs. Along the sides are ledges which the man who hangs the fish uses as steps, and upon which he places the poles on which the fish are hung. The fire is made on the bare floor; and for fuel oak shavings or shavings of other wood are used. The fish will keep according to the degree to which they have been smoked. In Yarmouth, England, herring are smoked and exported to India. For smoking, the haddock are opened in the same manner as in Denmark we open the salmon, and are packed in boxes. An English smoked haddock or herring is best fried or broiled. A large quantity of these fish also is exported to Hamburg.

Regarding the manner in which the haddock are prepared for smoking, a competent Norwegian authority says:

First, the head is cut off, the entrails are taken out, and the fish is well washed in tepid water. The abdominal cavity is well cleansed from all blood with a stiff brush, and after this has been done the fish is split, the backbone being left entire. After it has again been washed it is placed in the brine-box, which has a double bottom, the upper bottom being perforated, so that slime, &c., can gather. The haddock are left in the strong brine for ten or fifteen minutes. They are then hung for smoking on poles with hooks, which are arranged over a large fire which is lighted on the floor. For fuel oak and pine shavings are used (some writers state that peat also is used, but this is certain to impart a disagreeable flavor to the fish). During smoking the temperature is from 20 to 22° Celsius. The smoking process is completed in the course of one night. In cold weather the fish will keep eight days. Well-smoked haddock should be tender, and the inside should have a light, yellow-brown color. In cold-smoking the fish should not hang lower than 8 or 9 feet over the fireplace. In America halibut are smoked 8 feet over the fire. The temperature of the smoke should be about 20° Celsius.

Finally, we must mention a very simple and exceedingly practical method of smoking, which, though not to be recommended where smok-

ing is to be carried on as an industry, may often prove useful in every-day life. A fire is kindled somewhere in a field (the fuel should be green branches, heather, or juniper bushes), and the smoke is led through a trough or channel of boards to a barrel placed upside down from which the top has been removed. At the lower end an opening is cut to admit the boards, and the opening at the top is covered with mats or a sack, which allows some of the smoke to pass through. Sticks of wood are placed crosswise inside the barrel, and the fish are hung on these. For cold-smoking the channel is made 7 yards long, and for warm-smoking much shorter. In the latter process, in fact, the fire may even be made under the barrel.

139.—THE SAINT JOHN'S RIVER AS A SHAD STREAM.

By H. H. CARY, M. D.

I have just returned from Florida, and have been continuing my researches on the Saint John's River in investigating the habits of the shad in that stream. From the best information I can gather, it was not known that shad passed up the Saint John's at all until after the war, and I may say very few were captured until within the last few years. As there are no shoals in this river it has very much puzzled fish-culturists to ascertain where they cast their spawn. The Upper Saint John's has quite a number of broad, shallow lakes, beginning with Monroe and ending with Washington. These lakes have large areas of bottom consisting of clean sands. I am satisfied the shad casts her spawn upon these sands. It is somewhat difficult to gather up information in regard to the Upper Saint John's, as sometimes not an inhabitant can be found for 50 miles. The shad commence running in the Saint John's in December. Better appliances are now being used at Jacksonville for their capture than heretofore, and hence the catch is comparatively large. I was in Jacksonville on the 14th instant, and found a large supply of shad in the market, captured opposite the city. Upon investigation I found about an equal number of males and females, many of the females not quite, but very nearly, ripe. The river at this point is wide, so that the small nets used can capture but a limited number of the whole school that passes. And still at this point careful inquiry among the fishermen shows that from 2,000 to 2,500 are captured a day. Grown shad were selling in the Jacksonville market at 25 cents apiece. Now, if proper appliances were had in the Saint John's for capturing and artificially hatching, this river might easily produce an almost unlimited number of shad, as there is never any interference from ice; and as the watershed of the Saint John's is a sandy surface almost destitute of argillaceous matter, the water never becomes turbid, and there are comparatively no freshets.

DEPARTMENT OF AGRICULTURE,

La Grange, Ga., February 25, 1885.

140.—AMERICAN FISH IN FRANCE.*

By C. RAVERET-WATTEL.

During 1884 valuable shipments of the eggs of different species of salmon have been sent to France both by Prof. Spencer F. Baird, United States Commissioner of Fish and Fisheries, and by the German Fish-Cultural Society. Three thousand eggs of the *Salmo irideus*, or rainbow trout of California, were forwarded to our society from the establishment at Northville, Mich., according to the kind instructions of Professor Baird. I need not recount here the good qualities of the rainbow trout, whose beauty, vigor, and rapid growth make this species a valuable acquisition to our waters. Owing to the shipments due to the liberality of the U. S. Fish Commission and also to importations made at the same time by one of our members, the trout from the streams of California are rapidly becoming acclimated in France.

Very satisfactory reports are received concerning the acclimatization of California salmon (*Salmo quinnat*). According to information given by Dr. Maslieurat-Lagémard, general counselor of the department of Creuse, this salmon seems to have already spawned in the Gartempe River, while on the other hand Professor Valéry-Mayet, of the Agricultural College of Montpellier, reports that some of this species have been caught in the Aude and the Hérault River, where the common salmon is never found.

141.—CULTURE OF LANDLOCKED AND PENOBSCOT SALMON IN NEW HAMPSHIRE.

By E. B. HODGE.

[Letter to Prof. S. F. Baird.]

The landlocked salmon in many of our lakes have grown to an extraordinary size.* I measured one the other day (mounted) 33 inches long; weight, 12 pounds when caught; could not have been over seven years old. Another of 15 pounds weight was caught in Squam Lake, same age. Many others from 5 to 9 pounds have been reported to me by reliable persons. We have, in connection with Massachusetts, made a heavy plant of Penobscot salmon in the Pemigewasset River, which is the headwaters of the Merrimac. The largest fish that I have taken at the hatchery here was in last July—length, 42 inches; weight, 33 pounds; female. The spring run was all large fish; we have planted as follows: 1880, 300,000; 1881, 350,000; 1882, 400,000; 1883, 412,000;

* From annual report of the doings of the French Acclimatization Society in 1884. Monthly Bulletin of the Society, Paris, July, 1885.

1884, 600,000. A very large run of salmon came into the lower part of the river in September and October, but, owing to low water, did not come up as far as the hatchery.

Last year we distributed 85,000 Lake Superior fry, and this year we purchased 200,000 eggs, but unfortunately they were packed with green water-weeds, which fermented and raised the temperature to about 85°, which destroyed all the eggs. As we can purchase no more, I asked you for as many as you can spare us.

I have in the breeding ponds two or three hundred California trout, but not old enough to yield us any eggs this year. I impregnated some brook-trout eggs with the milt of the California trout last week. Should you desire to get a supply of the eggs of the whitefish, called pound-fish in Maine, you can obtain any amount you may want in Lake Winnepesaukee, a few miles from here.

PLYMOUTH, N. H., *January* 7, 1885.

142.—STATISTICS OF THE FISHERIES OF THE PROVINCE OF BRITISH COLUMBIA FOR 1884.

By GEORGE PITTENDRIGH,

Inspector of the Fisheries.

Number and value of vessels engaged in the different fisheries during the year 1884.

10 steamers and steam auxiliaries, from 3 to 96 tons	892 tons		$63,850
21 schooners, &c., from 5 to 80 tons			
878 fishing boats			42,755
198 canoes			
65 flat-boats			5,700
999 salmon nets, 295,770 yards			119,635
39 herring seines			4,980
5 herring nets, 700 yards			2,500
78 fish seines, 6,800 yards			6,800
3 oolahan nets			75
			246,295
25 salmon canneries, estimated value		$444,500	
1 oil factory, Skidegate, Queen Charlotte's Islands		10,000	
1 oil and scrap factory, Burrard Inlet		45,000	
1 floating cannery and oil factory		60,000	
Various salting stations		11,000	
			570,500
			816,795
Sailors			85
Fishermen	1,585		
Native hunters, with sailing fleet	296		1,881
Shoremen			1,315

Yield and value of the different fisheries in the year 1884.

Kind.	Quantity.	Value.
Salmon:		
Salted ..... barrels..	5,636½	$50,728 50
Fresh ..... number..	173,056	51,916 80
Canned, cases 4 dozen 1-pound cans	141,242	776,831 00
Smoked ..... pounds..	367,000	51,380 00
Sturgeon, fresh ..... do....	352,900	17,645 00
Haddock, whiting, &c ..... do....	240,700	9,628 00
Halibut ..... do....	150,000	9,000 00
Herring and smelt:		
Fresh ..... do....	34,550	1,727 50
Smoked	.....	6,500 00
Fish assorted ..... pounds..	58,400	3,504 00
Trout ..... do....	76,050	5,323 50
Oolahans:		
Fresh ..... do....	37,500	2,250 00
Salted ..... do....	33,000	2,640 00
Smoked ..... do....	28,000	2,800 00
Fur and hair seal skins	.....	156,419 00
Oolahan oil ..... gallons..	43	43 00
Black shark and dogfish oil, refined ..... do....	45,000	24,800 00
Dogfish oil ..... do....	10,000	3,500 00
Salmon oil ..... do....	1,452	580 80
Clams, canned, cases 4 dozen 1-pound cans	300	1,800 00
Fish sold in markets, not including New Westminister	.....	110,000 00
Fish cured for private consumption	.....	8,000 00
Salmon and other fish: Estimated consumption by Chinese and other laborers on the Central Pacific Railway, not specially recorded	.....	60,000 00
Eastern oysters imported and planted on beds ..... barrels..	10	200 00
Native oysters	210	1,050 00
Total	.....	1,358,267 10
Estimated consumption by Indian population as per previous computation:		
Salmon	.....	4,375,000 00
Halibut	.....	180,000 00
Sturgeon and other fish	.....	250,000 00
Fish oils	.....	80,000 00
		4,885,000 00
Grand total of approximate yield, 1884	.....	6,243,267 10

Comparative statement of yield of the years 1883 and 1884, exclusive of Indian consumption:

Total, 1883	$1,644,645 42
Total, 1884	1,358,267 10
Decrease 1884	286,378 32

143.—PETITION TO PROHIBIT THE SEINING OF BLUEFISH.

By FRED. W. DICKINSON.

[Letter to Prof. S. F. Baird.]

The firm in which I am partner (H. & J. Crosby & Co., Osterville, Mass.) and four hundred other petitioners from Cape Cod towns are soon to be granted a hearing by our legislative committee on fisheries on a petition to prohibit the seining of bluefish in the waters of Vineyard Sound controlled by the State of Massachusetts, between Wood's Holl and Chatham. Our reasons for asking the legislation are:

(1) In former years when bluefish were seldom taken except by hook and line or in weirs the fishermen had no difficulty in catching a full fare within a mile of shore, but within the past two years a great many

seiners have appeared and the fish have been driven farther and farther from the shoal water near shore, and during the latter part of the season of 1884 it was almost impossible to find a bluefish nearer shore than the Horseshoe—about 10 miles from shore. We understand that at least forty gangs of bluefish seiners are to fit out from Provincetown the coming season and as many more from other towns, and we feel that if seining is continued to be allowed on the shoal water the fish will soon be driven from their usual feeding-grounds, and no one, unless equipped with expensive gear, will be able to take them.

(2) The abolition of seining will be a great help to several hundreds of poor men on the south side of Cape Cod who depend almost entirely on what they make during the fishing season to support themselves and their families. None of them can get enough ahead to purchase sweep seines to compete with rich firms. This may appear a selfish reason, but in the little village of Osterville my firm paid to the fishermen $3,100 for bluefish caught by hook and line during the season between May 25, 1884, and September 1, 1884, and it was all paid to poor men; the ones who had any capital shipped their own catch. Of course if large lots of bluefish were taken in nets it would lower the price to the consumer, but I think the "charity" better bestowed on the poor fishermen than on the proprietors of summer hotels and beach resorts, to whom fully one-half of the bluefish shipped to this market are sold.

BOSTON, MASS., *February* 12, 1885.

144.—INTRODUCTION OF CLAMS INTO DELAWARE BAY.

By C. R. MOORE.

[From letters to Prof. S. F. Baird.]

Originally there were no clams in the Delaware Bay. Thomas Beesley, at Beesley's Point, N. J., was my informant, and it must be about thirty years since he told me. He said that many years ago the early settlers on the bay side of New Jersey, finding no clams there, combined and purchased 50,000 on the sea side and carted them over to the bay and laid them out fronting their farms on the bay. They have ever since had enough for their own use. It is the quahog. Thomas Beesley was so reliable and so careful in stating everything that I placed implicit reliance on anything that he told me. If I had brought this matter to your notice ten or fifteen years ago, I could probably have got all the information needed, but the old people that I used to know all through Cape May County are dead. I believe that the soft clam, or maninose, as it is called here, is found in only one spot on the sea side, while it is plentiful on the bay side. In New Jersey they are abundant on the sea side.

BIRD'S NEST, NORTHAMPTON COUNTY, VA., *January* 2, 1885.

145.—RAISING CARP IN A SUPPOSED ALKALINE WATER.

By E. S. STOVER.

[From a letter to Prof. S. F. Baird.]

In accordance with your request of August 21, 1884, I send you samples of young carp in alcohol, and 1 gallon of the alkali water in which they were raised. The carp were spawned in the latter part of May and the first part of June; not all at the same time, as some of the fish were kept in very cold water until late in spring. I lost four of my largest (two and one-half years old) at the fair by taking them from the warm pond water and putting them in a cold-water tank for exhibition. All in the pond are doing well; not one has died.

ALBUQUERQUE, N. MEX., *October* 21, 1884.

The water referred to reached Washington, October 28, 1884, and was referred to Dr. J. H. Kidder, chemist of the Fish Commission, for examination.

MEMORANDUM BY DR. J. H. KIDDER.

Five bottles (about 1 gallon) of water from E. S. Stover, Albuquerque, N. Mex., from his carp ponds, said to be "alkali water," in which carp were found to thrive. (Accession No. 15114.)

Pale yellowish green; offensive odor (sulphureted hydrogen); black flocculi; a considerable dark precipitate. Contents appear to have decomposed by standing. Reaction neutral. Sulphureted hydrogen is free and not combined with ammonia.

Total solids (of decanted liquid) at 130° C.=84 grains to a gallon. Blackens and loses 8.5 grains to a gallon on ignition. Contains 29.4 grains of chloride of sodium to a gallon. No iron, much lime (as carbonate and sulphate), small quantity of soda or potassa (as carbonate or sulphate), traces of magnesia and silica.

SUMMARY.

Total solids at 130° C. = 84 grains to the (imperial) gallon.	
Of which, sodium chloride =	29.4
Loss on ignition =	8.5
Not estimated (mostly lime and salts) =	46.1
	84.0

The residue is slimy, containing much organic matter, and presenting under the microscope only various forms of bacteria (micrococcus and bacilli) and of the lower fungi.

The specimen has probably changed in composition by putrefaction, and a further quantitative examination would be of doubtful utility.

The indications are that it is rather a "hard" than an alkaline water, and contains no greater quantity of lime and salts than is often met with in limestone districts, not certainly exceeding 40 grains per gallon.

SMITHSONIAN INSTITUTION,
Washington, D. C., January 7, 1885.

146.—NUREMBERG CARP EXCHANGE.*

The carp exchange, held in the Café Liebel, was opened by Mr. Staub, chairman. He stated that the Nuremberg Association had abandoned its idea of aiding carp-culturists by buying carp and selling them at retail, because such action might hurt the fishermen and the dealers, while the exchange ought to protect in every way the interests of producers and consumers. Mr. Staub also stated that an English gentleman intended to rent a fish-water at least 8 meters broad, and containing principally trout and "aeschen" (*Salmo thymallus*), and requested owners of such waters to send in their addresses.

The fishery association of Central Franconia had resolved, in the interest of fish-culture, to have a professional otter-hunter engage in otter hunting in the waters of Central Franconia. A Mr. Morris, of London, had offered to exterminate the otters in the waters of Central Franconia. Mr. Morris made only one condition, that in case an otter should escape into the forests, all owners of hunting-grounds should allow him to hunt otters on their territory for at least two or three weeks. This matter will be referred to Baron von Hermann, governor of the province, and president of the fishery association of Central Franconia, with the recommendation to accept Mr. Morris's offer.

At the exchange there were offered for sale 29,500 pounds food carp (37,000 the previous year), 1,400 pounds pike, 200 pounds tench, 3,100 pounds young carp, and 2,300 pounds carp fry. Owing to church festivals, no buyers were present from Schwabach, Fürth, and the immediate neighborhood of Nuremberg. In spite of this, all the fish were sold. The average price for food carp, weighing from 2 to 3 pounds apiece, was 70 marks [$16.66] per 100 pounds. Several fish-culturists from abroad have expressed their gratitude to the board of directors of the exchange, and to the Nuremberg Fishery Association, because they say that through the connections which they formed at last year's exchange they had been enabled last autumn and winter to sell their entire stock of fish. The president of a foreign fishery association, in a locality which is rich in fish, stated that this exchange enabled him to sell his fish for 10 marks [$2.38] more than at home. For this reason the fish-culturists of his district will attend in future. The exchange lasted three hours.

NUREMBERG, BAVARIA, *September 22*, 1884.

* "*Nürnberger Karpfenbörse*," from the *Deutsche Fischerei-Zeitung*, vol. vii, No. 40. Stettin, September 30, 1884. Translated from the German by HERMAN JACOBSON.

147.—AMERICAN HALIBUT-FISHERIES NEAR ICELAND.*

By A. THORSTEINSON.

In a recent article by A. Feddersen it was stated that the Americans had, in 1884, sent some vessels from Gloucester to Iceland to catch halibut, but nothing was said as to their success. It is well-known that the American halibut fishermen first came to the west coast of Greenland in 1866, since whalers had informed them that halibut were found there in great abundance. The first expedition left Gloucester on June 29, 1866, and returned on October 14 of the same year, with halibut to the value of $5,500. The American fishing vessel reached the fishing station a little too late in the season, otherwise the yield would have been greater. This expedition, therefore, did not attract special attention; nevertheless similar expeditions continued to be made from time to time, until public attention was again called to the matter in 1870, when a vessel was reported to have returned from Greenland with fish to the value of $19,000. The following two or three years 5 or 6 vessels were sent to Greenland every year; and gradually these fisheries developed to such an extent that in 1884 they were carried on by 20 vessels.

The first American vessel that engaged in the Iceland halibut-fisheries, off the western fiords, is said to have come there in 1873, but caught few fish, probably owing to the fact that the fishermen were not well acquainted with these waters, and because they had chosen the wrong season. Later the Americans are said to have fished every now and then on the west coast of Iceland, and seem to have been more fortunate. As Feddersen remarked, the Americans seem to have received a new impetus from information furnished by English fishermen. As far as I have been able to ascertain, the west coast of Iceland was, in 1884, visited by at least 3 American vessels, possibly by more; and as these fisheries, which are still in their infancy, are but little known, I will endeavor to give a short description of them.

The matter is of considerable importance, especially because there is every prospect that the halibut fisheries will pay well, and because they have this advantage over the cod fisheries, that they can be carried on during the most favorable season of the year and by vessels which cannot be better employed during their long stay near Iceland, as they come here early and leave late in the season. It is unfortunate that the Iceland cod-fisheries, in order to be carried on successfully by large vessels, must, as is done by the French fishermen, be commenced as early as March, when the cod must be sought close to the coast,

* "*Amerikanske Fiskere under Island*," from *Fiskeritidende*, No. 18. Copenhagen, May 6, 1885. Translated from the Danish by HERMAN JACOBSON.

with considerable danger both to vessels and crews, and be continued till near August. The shark fisheries are not very remunerative, either, during the light summer nights from the beginning of June till the middle of August, unless the fish are sought at a depth of from 150 to 300 fathoms, which is connected with great difficulties. These drawbacks would not be found as far as the halibut fisheries are concerned, which, properly speaking, can be carried on only from the middle of May till some time in August, always at a considerable distance from the coast, and therefore with less danger. The halibut, moreover, is a much better and more delicate fish than the cod, and will always bring a high price in places which are not easily supplied with fresh fish, especially when they are smoked, as is done in America, or when properly salted.

The information relating to the American halibut-fisheries near Iceland I obtained in the following way: On June 10, 1884, an American vessel from Gloucester arrived at Reykjavik, and engaged a well-known Icelander to accompany it on the trip, and my information is based on the report of this person. About the middle of June he went on board the schooner Concord, of Gloucester, 93¾ tons, a beautifully built vessel, which, as to construction, rigging, and sails, could not be distinguished from an English pleasure boat. The captain, John Daye, was a part owner of this schooner. It was specially equipped for the halibut fisheries, and well furnished with provisions of every kind (the men, for example, receiving fresh bread every day); the crew numbered 16, besides the Icelander referred to, and of this number 14 took part in the fisheries, while 2 always remained on board. The cargo was evenly distributed over 12 compartments without any passage between them. These compartments were separated by boards, but were not water-tight. With the exception of 2 compartments, one fore and the other aft, they were all filled with salt. The 2 empty compartments were intended for the first fish that were caught, and as the salt was gradually used up the compartments were one after the other filled with fish.

Long-lines alone were used in fishing; there were on board 7 dories, each for 2 men; these dories were placed one inside the other in two holds on the deck; each boat had four oars, one mast, and one sail, and was steered with an oar. While the long-line was cast or hauled in, only 1 man rowed. These dories proved to be excellently adapted to the purpose for which they were intended. Each dory had one long-line, and the number of hooks on each was from 600 to 800. The distance between 2 hooks was scarcely 2 fathoms; the line was a 5-pound line; the hook-lines being 2½ yards long and composed of 2-pound lines. The hooks were rather short and small, of blue color, with the barb at the top, and of such a size as to take more than two fingers to span the bend. They were very strong and bent but rarely.

The fisheries began off the western fiords in the middle of June, at first about 6 miles [probably Danish; 1 Danish mile equals about 4.7 English miles] from the coast off the promontory of Rytur (Isa Fiord), at a depth of fully 60 fathoms, on a white sandy and clayey bottom, and were continued along the coast in a northerly direction, until the northeastern cape had been passed. The vessel was rarely more than 7 miles from the coast, generally between 6 and 7 miles [from 28 to 33 English miles?].

As bait, the Americans used in the beginning a kind of salt herring [menhaden?] unknown to the Icelander; but they soon ceased using this bait, because fresh bait proved more advantageous, and small flounders and other fish were used for this purpose. The bait was cut in long, narrow strips with the skin on, about an inch broad, and 6 or 7 inches long. One end of the hook was passed through the flesh and the skin. The baiting was invariably done on board the vessel.

When the weather was favorable, and after the vessel had reached suitable fishing-grounds, where good hauls might be expected, the anchor was cast, the long-lines were laid ready in the boats, and these were then immediately lowered. The 7 boats left the vessel, and set the long-lines at different distances from the vessel, the distances between the lines, however, being the same, each line forming a semicircle, whose center was the vessel. Each end of the line had a buoy; and a small anchor was used of about the same size as those used in large fishing-boats. The long-line was left in the water six or eight hours, never longer, but a shorter time when the weather was bad. It did not take long to set the lines, but somewhat longer to haul them in, especially when there were so many fish on them that the boats had to make several trips to the vessel. The largest catch made in one day was 800 fish, often it was 300 or 400 or 500, rarely less than 300; and when the weather was fine, some fish were caught every day. These long-lines were so excellently constructed that they always gave way, so that the halibut but rarely slipped from the hooks; but when the lines were in the water for a long time, it would happen that some of the hook-lines tore. When the weather prevented the hauling in of the lines the vessel lay at anchor. Thus during a strong wind from the north the vessel lay for a whole week before the lines could be hauled in, and on this occasion 3 or 4 long-lines were lost. Sharks had torn them and bit off the greater part of the halibut, leaving the heads.

The halibut which were caught were generally of medium size, rarely weighing more than 300 pounds; and there were but few small fish among them. A few rays were also caught, but thrown overboard, and some lumpfish, ling, and cod, which were cut up for bait. The largest catch was made off the Dyra Fiord; but in every place some fish were caught. The fisheries were therefore successful, much more so than those carried on the year before near the coast of Greenland. The American fishermen, therefore, did not deem it necessary to go out any

farther than the distance stated above, more especially because fishing at a greater depth is slower, and requires more exertion on the part of the fishermen. In many places two or three hauls were made in succession, the vessel often making no more than from 3 to 5 miles (English) between the hauls.

As soon as the fish had been brought on board, they were put in boxes which had been placed on deck for that purpose; but fishing was going on without interruption as long as the weather permitted. As quickly as could be done under the circumstances, a beginning was made in preparing the fish. A large board was placed with the upper end against the rail, and the lower end on the deck. A rope was then fastened to the tail of the fish, and it was drawn up on the board, the tail upward and the head downward. First a cut was made near the tail, and the sides were cut from the bones. The fins went with the sides, but were, together with the entrails, removed later. After all that could be used as bait had been cut off from the head, the rest was thrown overboard, because the catches were so large that it was not needed. The fish was then washed clean, and the sides were, without cutting the skin, salted down in boxes in the hold of the vessel, the skin side upward and the flesh side downward, and well covered with salt. The fish were salted again after about three weeks. The salt was shaken off well, and the fish were again laid in the boxes with somewhat less salt. The fins and pieces of the stomach were put in barrels and exposed to considerable pressure, whereby they absorbed sufficient brine, the barrels having been left open for some time. The salt used was coarse-grained salt, resembling the Spanish salt.

The Icelander from whom I obtained this information was on board six or seven weeks; but he was not able to tell exactly how many fish were caught, as he was not informed as to the number. He supposes, however, that it amounted to from 7,000 to 8,000 fish. At the same time two other American vessels were engaged in these fisheries near the western fiords. One of these vessels had on board a well-known man from the western fiords, who states that about as many fish were caught as by the Concord; but the third vessel had no Icelander on board and did not catch near as many fish. That the quantity of fish caught by the Concord was very considerable might also be judged from the circumstance that of the twelve boxes or compartments nine were completely filled with salt halibut.

As wages the crew received half the quantity of fish caught, and board and everything else was free on the vessel. The captain engaged the Icelander who furnished me the above information to hold himself ready next summer to accompany another American vessel during the halibut fisheries.

NOTE.—See article in F. C. Report, 1884, by Capt. J. W. Collins, entitled "The Icelandic Halibut-Fishery—An account of the voyages of three Gloucester schooners to the fishing grounds near the north coast of Iceland."—EDITOR.

Vol. V, No. 28. Washington, D. C. Sept. 30, 1885.

148.—SENDING CATFISH TO EUROPE.

By CHAS. W. SMILEY.

The Fish Commission, through its New York agent, Mr. E. G. Blackford, responded to several European calls during the past summer.

The catfish sent were the *Amiurus nebulosus*, from the Delaware and Schuylkill Rivers. This is a great favorite in the Philadelphia market. Mr. Blackford sent them to the care of Messrs. Draper & Wood, at Havre. They are a year old, and will breed within a year or two.

Germany.—June 16, 1885, 50 live catfish were sent to the Deutsche Fischerei-Verein, care of F. Busse, Geestemünde, per steamer Ems July 17, Max von dem Borne wrote from Berneuchen that 49 had safely arrived, and been placed in a pond.

France.—By steamer Amérique, of the Compagnie Générale Transatlantique, on July 18th, Mr. Blackford sent 100 catfish in six cans, consigned to Messrs. Draper & Wood, 79 Rue de Orleans, Havre, France. Of these 50 were forwarded to W. Coleman Burns, of the United States Mortgage Company, 25 Place Vendome, Paris, who wrote, July 7, as follows: "The fish arrived in excellent condition. They are intended for Mr. Ridgway, formerly of Philadelphia, who now owns and occupies the beautiful château of Riequebourg, near Compiègne. I sent the fish to him in charge of an expert, and am informed by the latter, upon his return to Paris, that about 40 fish in a fine state of health and activity reached their new home. Mr. Ridgway writes to me as follows: 'Thierry arrived with the fish this morning. We have just put them into the reservoir, and I hope they may continue as lively as they are now. I cannot thank you enough for the immense trouble you have taken. I am sorry only that you did not see them take their first bath in Riequebourg waters.' I have this day sent Mrs. Ridgway your kind and lucid directions about the management of these fish, and both she and Mr. Ridgway are already well aware that it is to you and to Col. Theodore Lyman that we owe the very great pleasure which we have thus been able to procure."

The other fifty were for the Acclimatization Society of France. The secretary, Raveret-Wattel, wrote, July 29, 1885, in acknowledgment, as follows:

"We have received in perfect condition the *Amiurus nebulosus* that you have had the kindness to send to our society with Mr. Blackford's co operation. During the passage and in the first three days after their

arrival we lost 9 of the young fish; but the 41 left are very lively, and I hope they will thrive perfectly well in their new home.

"We are very grateful for a present which enables us to acclimate a species so valuable as catfish, not injurious to other fishes, and contented with stagnant or muddy waters. It will be, I trust, a good acquisition, and I will not fail to inform you of the results."

Netherlands.—The same week 30 catfish were sent by Captain Taat, of steamship Edam, for the Zoological Garden at Amsterdam. July 7, Dr. C. Kerbert wrote in reply:

"I have the honor to communicate to you that I have received 30 catfish, in the best condition. I thank you very much for this present. I hope that the catfish will hatch here in the aquarium; in this case I shall write you immediately. They are the first catfish introduced into Europe. I mean that the experiments in 1882 by Mr. Thomas Wilson at Ghent, in introducing the catfish in Belgium, have produced no results."

England.—June 20 there were sent by the White Star Line 50 catfish to the National Fish Culture Association, South Kensington, London. The success of the shipment was reported by the secretary, W. Oldham Chambers, in his letter of July 10, as follows:

"I received with much pleasure your letter of the 18th ultimo, intimating that you had sent 50 catfish as a present to this country. You will be pleased to hear that 48 of them survived the journey and were immediately placed by me in the tanks of this aquarium prior to their removal to our fish-culture establishment at Delaford Park. I shall do my utmost to propagate the species in order that this valuable food-fish may be acclimatized in the waters of Great Britain."

The following notice occurred in the London Globe of July 11, 1885:

"Mr. W. Oldham Chambers, F. L. S., director of the National Fish Culture Association, has received from the United States Commissioner of Fisheries a consignment of selected specimens of catfish indigenous to the waters of America. They arrived by the steamship Britannic, in perfect condition, all being alive, and apparently none the worse for the voyage, which, considering the time it occupied, is remarkable. These fish are of great economic value, and it is intended to naturalize them in English rivers, where it is considered they would assume a high rank among freshwater fishes. The catfish possesses a peculiar scarcity of small bones, and it is regarded in America as a valuable food-fish. Although this species does not produce a large number of eggs, it possesses an extraordinary instinct for protecting its eggs and young. Pending the removal of the fish to the waters belonging to the association, they will be exhibited to the public in the aquarium at the Inventions Exhibition."

U. S. FISH COMMISSION,

Washington, D. C., September 10, 1885.

149.—NOTES FROM THE CARP PONDS.

By RUDOLPH HESSEL.

In the ponds the fish are looking well, the ponds themselves have good water, and everything around the whole place is in excellent condition. I often have to change the water in the smaller ponds, and to supply the larger ponds (the west, north, and south ponds) with fresh water, on account of the high temperature. Snakes are almost all gone or killed; I have not seen one during the last eight days. The marsh-hens and cranes cause considerable loss by their frequent visits.

For the 19th or 20th of July a shipment was ordered of about 20,000 young carp to Mr. E. G. Blackford at New York. I tried to get them for that time, but without any success. I was convinced that all the young fish would die if taken out of the ponds. These fish are a great deal larger than those we sent some weeks ago, when about 2,000 were lost. The young fish in the ponds now cannot be shipped before fall.

I have observed something interesting about the young shad in the western part of the west pond. Some days ago I saw a small school of about 200 to 300. Yesterday I saw another one of about 3,000. One that I caught and put in alcohol was about 2 inches long. I am convinced that not many hundreds are in the ponds, but plenty of them for investigating the matter of their growth.

Pond No. 6 now has the richest growth of nelumbiums I ever saw. The vegetation is even with the wire fence and the flowers are about 1 foot higher, making the growth fully 7 feet high. I counted this morning about 350 open flowers of nelumbiums in this pond. All the nelumbiums in this pond got some bone-dust this spring, and the insects (moths) are almost all destroyed.

WASHINGTON, D. C., *July* 26, 1885.

150.—EFFORTS TO RAISE TROUT.

By S. B. SMITH.

[Letter to Prof. S. F. Baird.]

Having obtained a copy of Thad. Norris's works, I determined to experiment in trout-culture. Three years ago I cleaned up a small swamp adjoining my spring-house and excavated four small ponds, ordered 1,000 fry from Dr. A. Garwood, of Cassopolis, Michigan, and a few weeks later 4,000 of the fry, 115 yearlings, 30 two-year-old, and 9 three-year-old trout of J. H. Annin, Caledonia, Livingston County, New York. A few

weeks after I got them the screens were accidentally left up a few inches, and nearly all of my yearlings escaped, going down the ditch into Mad River, about a mile below my ponds. Last year some were caught in the Macocheek, near the residence of Col. Donn Piatt. This fall they, or at least some, came back into the ditch, and I captured 19 very beautiful ones, weighing from three-fourths pound to $1\frac{6}{16}$ pounds, showing that they had done better in Mad River than in my ponds, although I had fed those in the ponds daily.

Our county (Logan) is the highest in the State, containing many brooks, all having their sources in the county; therefore I feel confident that by stocking them with trout fry instead of lake pickerel (as has been done to no advantage whatever, none having been caught as yet), within a short time there will be great benefits derived. I have now a hatching house and have succeeded in hatching 3,000 within the last two weeks, and think I have capacity for 500,000. In my ponds (or one of them) there are 10,000 yearlings doing well. As far as I can learn, I am the second person in the State who has attempted to hatch or raise trout; and I have had the usual troubles and losses.*

ZANESFIELD, OHIO, *January* 23, 1885.

151.—PROPAGATION OF TROUT BY THE SOUTHSIDE CLUB.

By H. R. CLARKE.

[From a letter to Prof. S. F. Baird.]

I send with this a female rainbow trout that died at the South Side Club day before yesterday. It weighed when taken from the water close to 4½ pounds and is from the original gift of eggs you sent us four years ago last spring. We have left now about 80 of the first lot that were hatched from your 500 eggs, about 800 that are of the next generation, weighing from 1½ to 3 pounds, and between 5,000 and 6,000 yearlings that will weigh one-half pound and over. I send you the fish to show to inquiring legislators in case they doubt your success in fish-raising. Our *fontinalis* are through spawning, and we have in the hatchery 900,000 eggs in fine condition, with about 20,000 already out. We have as yet no rainbow-trout ova, but appearances indicate that we shall commence stripping some before long. Last year we got 1,000 eggs by December 20. They are later this year, and perhaps may continue to spawn later and later until they come back to first principles and spawn as late as they do in California.

237 EIGHTH STREET,
Jersey City, N. J., January 3, 1885.

* On September 19, 1885, Mr. Smith wrote: In May, 1884, I obtained 68,000 rainbow-trout fry from Michigan: 5,200 of these were placed in the Blue Jacket, a tributary of the Miami River, and some have been caught there weighing over one-half pound each.

152.—ARTIFICIAL HATCHING OF SALT-WATER FISH AND LOBSTERS IN NORWAY.*

By G. M. DANNEVIG.

[From his report on the London Fisheries Exhibition.]

I take this opportunity to report briefly what has been done in Norway, and what we intend to do if the necessary funds can be raised. The establishment for hatching salt-water fish is now (1883) in course of construction and will be completed in autumn. The ground covered by the building is 1,200 square feet. This building, besides affording room for machinery, an office, &c., will have room enough to place apparatus sufficient for holding about 80,000,000 eggs. It is intended to put the establishment into operation as early in the spring of 1884 as possible; that is to say, as soon as mature roe can be obtained. It is of course impossible to foretell the result, and I must therefore repeat what I have stated frequently: "The possibility of hatching fish eggs has been demonstrated so frequently that we need not entertain any doubt on that subject." How far local circumstances on our coast will prove a hindrance, and how far the hatching, if successful, will improve the fisheries, are questions that can be answered only by experience; and it is therefore desirable that the experiments should be made on so large a scale that obvious results may be obtained. The experiments will in the beginning relate only to cod, but later it is the intention to extend them also to other salt-water fish. But as it would seem like poor economy to let an establishment like the one under construction stand idle during nine months of the year, when mature roe of good food-fish can be obtained at almost any time, the experiments will probably be continued during spring and summer by hatching flounders, and perhaps mackerel. Flounders for this purpose could easily be obtained from Denmark; and there is reason to suppose that eventually we shall succeed in importing impregnated roe instead of the live fish containing the roe. Attempts in this direction will be made during the coming winter; and it should be kept in mind what an immense advantage it would be to be able to ship the impregnated roe of salt-water fish in considerable quantities at a small expense.

The hatching of lobster eggs, however, should especially engage our attention during summer, all the more as the gathering of the roe may be carried on to any extent whatever and with very little expense; moreover, we get the roe already impregnated, and ready for our experiments; which of course is a matter of no little importance. The question as to the possibility of hatching lobster eggs after they have been separated from the mother lobster I consider as satisfactorily solved

* Translated from the Danish by HERMAN JACOBSON.

by some experiments made by me last summer; and I will here give a brief report on the same.

On July 8 I took about 200 eggs from a lobster which I had for some time kept in a small fish-tank. About two-thirds of these eggs I placed in a glass of water, over the open end of which I tied a piece of gauze, and then suspended the glass in the sea, bottom upward. As the roe of the lobster is heavier than water, it of course sunk down and remained lying on the gauze, thus coming in the closest possible contact with the water underneath. The remainder of the roe I kept in a vessel in my room, changing the water several times every day. Later I took some eggs of both portions every day and examined them under the microscope, returning them again to the two vessels. The result was as follows:

At the first examination a faint pulsating motion could be observed in several eggs, but no separate organ whence this motion originated could be noticed. The general color of the young was light gray, with numerous sharply defined streaks, patches, and points of a bright red color. The umbilical sac, of a dark green color, took up the fore part of the body, and had a deep indentation along the line of the back. The eyes were large, dark blue, and motionless. There were indications of feet and feelers. The animal lay curled up in the egg, the distinctly split tail passing between the eyes. Later it was noticed that as the development progressed the umbilical sac decreased in size, while the red color spread more and more. The pulsating motion also increased, the center of this motion appearing to be in the hindermost portion of the fore part of the body. On July 17, nine days after the roe had been taken from the mother lobster, the shells began to burst, and I deemed my task accomplished; but unfortunately the principal difficulties began at this time. As I stated before, I had suspended the glass with the eggs in the sea, but I made the grave mistake of suspending it over a grassy bottom instead of a rocky bottom, which is the proper place for young lobsters. The consequence was that a large number of all kinds of small animals gathered under the glass and penetrated through the gauze covering to the eggs inside the glass, where they created considerable disturbance. Several times I was obliged to take up the glass and clean the eggs; but as none of them appeared to suffer, I determined to carry my experiment to the end without changing the location of the eggs. When the young had left the outer protecting shell the conditions were changed, however, and the small animals, which heretofore had been quite harmless, destroyed one young lobster after the other, until on July 20 I gave up all hope of getting a single one beyond the first change of skin, and therefore placed all that remained in glycerine.

Thus far, however, the result was satisfactory, as my opinion that lobster eggs can be developed after they have been taken from the mother lobster was completely confirmed; and I have every reason to believe

that this useful crustacean may be hatched on a large scale if care is taken simply to have sufficiently salty and pure water, which may easily be obtained by means of a filtering apparatus. The current should always come from below, so as to carry away the small animals which may develop among the eggs. As, however, I could not consider the question as completely solved before I had observed young lobsters able to swim, I sent the directors of the Arendal branch of the Norwegian Fishery Association a report of my experiments, with the request to grant me the necessary funds for continuing and completing them. I did not receive the desired grant, and the question must therefore still be considered as partially unsolved. There is every probability, however, that the project is feasible; and the best and cheapest way to promote the lobster fisheries will probably be to hatch large quantities of young lobsters and place them in the open sea as soon as they are able to swim, which point, I think, they reach during the first change of skin.

HATCHERIES.—If we examine the reports of the inspector of fisheries on the Norwegian fish-hatcheries, we find but little to encourage us. It appears that prior to 1875, 142 hatcheries had been established in the inland districts, but that in 1875 only 33 were in operation, and that in 1874 only 17 were stocked with roe.

From later reports it appears that during the period from 1875 to 1879 the statistics of the Norwegian hatcheries are as follows:

IN NORWEGIAN HATCHERIES.

Year.	Number of hatcheries.	Number in operation.	Hatcheries for which the number of fry is given.	Number of fry.	Hatcheries for which no data are given.	Estimated number of fry in these hatcheries.	Total number of fry.
1875–'76	22	14	10	457,000	4	183,000	640,000
1876–'77	24	17	12	373,000	5	185,000	528,000
1877–'78	27	17	14	456,000	3	98,000	554,000
1878–'79	34	22	18	611,000	4	136,000	747,000
Average	27	17–18	13–14	475,250	4	150,500	617,250

IN THE SALMON STREAMS.

1875–'76	31	23	20	1,432,500	3	214,900	1,647,400
1876–'77	31	21	21	1,058,500			1,058,500
1877–'78	31	15	13	816,800	2	125,700	942,500
1878–'79	32	19	17	887,000	2	104,400	991,400
Average	31	19–20	18	1,048,700	2	148,333	1,159,700

Briefly stated, then, the facts are that in Norway, in the course of the last 25 years, about 200 hatcheries have been established; that during the period from 1875 to 1879 there were on an average 58 in existence, and that of these 37, or a little more than one-half, produced young fish. The annual average number of young fish during the period referred to would therefore be 30,600 per hatchery.

The entire production of young fish, both salmon and other freshwater fish, is therefore only about 1,750,000 per annum. If we compare our results with those obtained in Canada and the United States, we find the following:

Country.	Number of hatcheries.	Number of young fish per hatchery.	Total number of young fish per annum.
Norway	58	30,600	1,777,000
Canada	11	1,956,400	21,520,000
United States	9	2,222,200	20,000,000

This table will show at a glance where our mistake lies. We have too many and too imperfect hatcheries; and if, moreover, as is often the case, they are managed by inexperienced persons, who receive no salary, and who can barely spare the time to superintend the hatcheries, these discouraging results will surprise no one.

If the 58 hatcheries which are in operation were reduced to 10, and if these were located in favorable places and properly superintended by experienced men specially appointed for the purpose, the results would be much better, without necessitating a much greater expense. It is of course understood that the superintendents of these hatcheries should receive a suitable salary.

153.—SALMONIDÆ IN AUSTRALIA.*

By G. M. DANNEVIG.

[From his report on the London Fisheries Exhibition.]

In examining the list of the different kinds of fishes which are generally brought to market in Tasmania, and which form the principal food-fishes of the population, we find the name "*Salmo trutta*," and in the column of observations opposite this name we read: "Imported from Europe; now found everywhere."

The facts are as follows: The salmonoids, which are numerous and common throughout the northern hemisphere, were altogether wanting in Australian waters. As early as 1841 their importation from Europe was thought of, which, however, owing to the slow mode of transportation, seemed an undertaking fraught with insurmountable difficulties. In 1852 the first attempt was made, when the ship Columbus (bound to Tasmania) took out from London 50,000 eggs of salmon and salmon trout. The attempt proved an entire failure. The high temperature to which the eggs were exposed caused all of them to die in a comparatively short time. The next attempt was made in 1860. Impregnated roe was sent out in January by the ship Curling, with a quantity of ice,

* "*Salmonider i Australien.*" Translated from the Danish by HERMAN JACOBSON.

by means of which it was hoped to insure low temperature in the apparatus; but when, after 59 days, the ice had melted, and the temperature rose rapidly in consequence, all the eggs perished in a few days. The third attempt was made in 1862, when in March the ship Beautiful Star left London with 50,000 salmon eggs, placed in a hanging apparatus, and, as the last time, kept on ice. The ice lasted till May 17, when the eggs died rapidly, 74 days after they had been shipped and 80 days after they had been taken from the fish. Although this attempt must likewise be considered a failure, it proved the important fact that salmon eggs, even under unfavorable circumstances, could be kept alive for 80 days; and as in London the possibility had been shown of hatching salmon eggs which had been laid in ice for 150 days, it was believed that the problem of introducing salmon into the Australian rivers would be satisfactorily solved in the near future.

This belief was well grounded. On January 24, 1864, the ship Norfolk sailed from London for Melbourne, carrying 90,000 salmon eggs and 1,500 salmon-trout eggs, and an ice-house holding a considerable quantity of ice. The ship reached its destination on April 15; and after a small portion of the eggs had been landed at Melbourne, the rest were conveyed to Hobart Town, Tasmania, by steamer. Upon their arrival at Hobart Town they were placed in the hatching apparatus on the River Plenty on the 21st of April, 90 days after they had left London. On May 4 the first salmon trout was hatched, and on the following day the first salmon. On June 15 the number of young fish was estimated at 3,000 salmon and 300 salmon trout, which, after having reached a suitable size, were gradually placed in open waters.

Encouraged by this success, the Tasmania Government determined to make a new attempt; and the ship Lincolnshire, which sailed from Plymouth on February 8, 1866, took out 103,000 salmon eggs and 15,000 salmon-trout eggs. The ship arrived in Tasmania on May 4, and on the following day the eggs, of which 45 per cent were still alive, were placed in the apparatus, and in due time 6,500 young fish were hatched. The work has been continued by taking roe from fish which had reached maturity in Tasmania, and at the present time the salmon trout especially is considered well acclimated in the rivers of New Zealand, Tasmania, and Victoria. A large number of young fish and eggs have been sent also to West Australia, but it is not known what has been the result.

From 1864 to 1881, 263,500 eggs and young fish have been placed in Australian waters. Salmon and salmon trout are now caught frequently, and it is stated that thus far the largest salmon caught in these waters weighed 28 pounds.

From statistics relative to the different rivers where young salmonoids have been placed we find the following results: The fish increased rapidly in 5 rivers; the fish increased in 44 rivers; the fish supposed to

increase in 2 rivers; increase varying in 8 rivers; the fish decreased in 17 rivers; no fish observed in 10 rivers; no statistics in 24 rivers.

Several varieties of carp, perch, and other freshwater fish have also been introduced into the Australian rivers and lakes during the same period, and, on the whole, with satisfactory results. Especially the common tench (*Tinca vulgaris*) and the common perch (*Perca fluviatilis*) have in a comparatively short time increased very much, and may now be considered as entirely acclimatized in Australia.

154.—NEW ENGLAND FISHERIES IN AUGUST, 1885.

By W. A. WILCOX.

August shows a decided improvement in receipts, prices, and demand for the leading varieties of salt-water fish. Codfish have been fairly abundant on the Grand Banks and also on George's Bank. During August few cod were found on Brown's Bank, and most of the vessels changed for George's. The receipts of the month at Gloucester aggregate only about one-half as much as the corresponding month last year. The home fleets have landed an average amount, the falling short being mostly Canadian vessels, as low prices and the duty keep out the customary large receipts brought by foreign vessels. With a large falling off in the aggregate receipts, the market has at all times been fully supplied and prices have generally been low.

The schooner Byron was the first vessel since the termination of the Washington treaty to pay a duty on a cargo brought from the fishing banks. She arrived at Gloucester on August 20, with 300,000 pounds of codfish caught on the Grand Banks. This was the only cargo of fish from the banks that paid a duty during the month.

The shore fleet, ground-fishing off the eastern coast, reported less than the average catch, as fish were scarce. Off the Massachusetts coast a light catch is expected this season, as a large number of the vessels usually engaged have changed to the mackerel or swordfish fishery. As compared with former years receipts have been up to the average.

Mackerel receive more attention at this season than all other fish, the catch, movements of the fleet, receipts, and fluctuations of the market being closely watched. During the past month, with the exception of a few sail in the Gulf of Saint Lawrence, the vessels have worked along the New England coast from Boston Bay to the Bay of Fundy. Mackerel were found abundant, the fleet landing 106,316 sea-packed barrels* during the month, this being only 10,520 barrels less than the entire amount of sea-packed barrels landed at all ports during 1885 up to August 1.

*Sea-packed barrels are so called from the mackerel having been cured and packed at sea. At that time all sizes and qualities are packed together. On reaching port they are repacked, sorted, and inspected by a commissioned State inspector.

The small fleet from New England in the Gulf of Saint Lawrence found the mackerel fishery very uncertain. At times fish were abundant, at others scarce, while the size was small and quality inferior. Twenty-two sail returned to land their cargoes or complete them off the New England coast, where they remained. Twelve sail, all belonging at Gloucester, comprise the North Bay mackerel fleet from the United States at the close of the month.

From a daily record at the leading ports the following extracts relating to the mackerel catch are given:

August 7.—During the past week the mackerel fleet landed at all ports 40,150 barrels of sea-packed mackerel. We have only one record of so large an amount ever having been landed in one week, that being the week ending September 12, 1884, in which 42,319 barrels were landed.

The large amount of the past week was taken mostly off the New England coast, the amount received the past week from North Bay by 11 sail being 4,905 barrels, and by railroad, from Gloucester vessels that remained in hopes of finding large fish, 736 barrels.

August 9.—Eighty sail were fishing between Ipswich Bay and Isles of Shoals; 20 sail were off Marblehead; a large fleet were working west from the Bay of Fundy; the Block Island and Cape Cod fleets were working east; the North Bay fleet nearly all left the Gulf of Saint Lawrence for the New England shore or home ports. But few fish taken during the past week in any direction.

August 10.—Twenty-one arrivals at Gloucester landed 5,855 barrels of mackerel, taken as follows: One from off Block Island, 100 barrels; 2 from Massachusetts Bay, 280; 9 from the eastern shore and Bay of Fundy, 3,120; 2 from the North Bay, 760; 7 from Barnstable Bay, 1,595.

Boothbay, *August* 14.—Much fog, and few mackerel being caught.

August 17.—Continued foggy weather has detained 60 sail of seiners in this harbor. Clear weather to-day sends them to sea.

August 24.—A strong southerly breeze brings in 75 sail of the mackerel fleet for a harbor.

Gloucester, *August* 17.—The mackerel fleet continue scattered from Cape Cod to the Bay of Fundy. A few good hauls made the past week in Massachusetts Bay. Schooner Volunteer has taken 500 barrels there during the past two weeks. Fish are of good size and quality.

August 20.—Large quantities of mackerel now in Massachusetts Bay, but too near the rocks for much of a catch. These fish are the largest, fattest, and best found anywhere, and bring from one to two dollars a barrel more than mackerel caught to the eastward or in the Gulf of Saint Lawrence.

August 28.—The mackerel fleet are now scattered from off Monhegan to Mount Desert. Fog and rough weather continue much of the time. Mackerel are mixed with large quantities of alewives, and only a light catch is being taken. Fish now arriving mostly caught well to the

eastward, and of a poorer quality than those taken in Massachusetts Bay.

August 31.—Most of the mackerel fleet are now between Monhegan and Cape Elizabeth, Me., and are having a moderate catch, the schools being small and mixed with alewives, great quantities of which are taken with the mackerel.

The fishermen all report never having seen or heard before of such quantities of alewives at this season of the year. From their description the fish are no doubt the *Clupea æstivalis*, glut herring, or blueback.

None of the mackerel seiners saved any of the alewives. Two small steamers that have been engaged in the shore whale-fishery and a few other small vessels have been engaged in capturing these alewives and selling them to the oil and fertilizer factories at Booth Bay, receiving 40 cents a barrel for them. The fish are of good size, very fat, and said to produce 3 gallons of oil to the barrel of fish.

The close of the month finds the mackerel fleet located as follows: 50 sail off Mount Desert; 50 sail off Isle au Haut; 80 sail off Monhegan; 20 sail in Gulf of Saint Lawrence.

The remainder of the fleet were scattered between Cape Cod and the Maine coast. During the past two weeks the catch showed a large falling off in all directions.

August 31.—The first steamer ever built for the mackerel fishery arrived at Gloucester to-day, took on her four seine-boats, and went to sea. This steamer, the Novelty, is 150 feet long, 27 feet beam, 11 $\frac{3}{12}$ feet hold, gross tonnage of 294, net 197.45, is schooner rig, carries four seine-boats, two being swung on davits on each side of the steamer, four seines, and a crew of 40 men. It is furnished with engines of 450 horse-power. The Novelty enters the field too late to demonstrate this season whether steam is a benefit and liable to lead to another radical change in the mackerel fishery or not. She is a fine seaworthy-looking vessel, built and commanded by Capt. H. C. Joyce, one of the ablest and most successful fishermen in New England, and her future will be watched with much interest.

Prices of mackerel per barrel at Gloucester during August, 1885, (sales being made by the cargo).

Date.	Shore.	Bay of Fundy.	North Bay.
August 5	$3 00		$2 25
8	4 00		2 30
10		$2 75	2 25
11		2 00	
17	6 00		3 00
20	6 50	5 00	3 25 to 3 50
25	7 00 to 7 30		4 00 to 4 25
28	6 00 to 7 00		

Receipts of fish at Gloucester, Mass., in August, 1885.

From—	Fares.	Codfish.	Halibut.	Cusk.	Hake.	Haddock.	Swordfish.	Mackerel.	Menhaden oil.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Bbls.*	*Bbls.*
George's Bank	156	2,890,000	206,600	12,000					
Brown's Bank	27	687,000	7,850						
Grand Banks	41	2,797,000	898,500						
Cape shore	14	275,000						2,014	
New England shore	9	71,000		12,000	54,000	42,000			
New England shore and Bay of Fundy	12						70,345		
Banquereau	2	72,000		15,000	15,000				
Grand Banks (British schooner)*	1	330,000							
Tiverton, R.I.	2								700
Eastern shore and Bay of Fundy	109							30,843	
Gulf of Saint Lawrence	21							8,195	
Railroad from Gulf of Saint Lawrence								2,002	
Steamer to Boston from Gulf of Saint Lawrence								910	
Massachusetts Bay	15							3,618	
Block Island	5							655	
Total	414	7,122,000	1,112,950	39,000	69,000	42,000	70,345	48,237	700

* Subject to duty.

There were received also, from 20 small boats fishing in Massachusetts Bay, 90,000 pounds hake, 17,000 pounds codfish, and from traps in the harbor 770 barrels fresh mackerel.

Mackerel landed by the New England fleet, in sea-packed barrels, at all ports.

	Barrels.
Up to August 1, 1885	116,836
Week ending August 7	40,150
Week ending August 14	18,363
Week ending August 21	18,584
Week ending August 28	19,066
Three days ending August 31	10,153
Total to September 1	223,152

Location of the New England fishing fleets the last week in August:

330 sail, mackerel, between Cape Ann and Mount Desert;
20 sail, mackerel, in Gulf of Saint Lawrence;
38 sail, halibut, on the Grand Banks;
187 sail, codfish, on the Grand Banks and Banquereau;
155 sail, codfish, on George's and Brown's Banks;
12 sail, codfish, off the Nova Scotia shore;
250 sail, ground and sword fishing, off the New England coast;
11 sail, for halibut, off Greenland and Iceland;
6 steamers, taking whales, off the New England coast.

Total, 1,003 sail and 6 steamers.

The mackerel fleet have landed, in sea-packed barrels, up to September 1, 1885, 223,152 barrels; 1884, 202,584 barrels; 1883, 87,054 barrels; 1882, 251,955 barrels. Vessels are now arriving from Banquereau and the Grand Banks with full fares of codfish.

GLOUCESTER, MASS., *September* 25, 1885.

155.--HATCHING LOBSTERS IN NORWAY.*

By G. M. DANNEVIG.

[From a letter to Prof. S. F. Baird.]

If the question was as to whether it would pay to catch the lobsters for hatching purposes, hatch the eggs artificially, and liberate the fry immediately after hatching, I should answer that it would not pay, as the lobsters themselves can do the hatching much better than the best of human inventions. If after the hatching we could rear them for at least six weeks, then I think it would pay; for, although the losses in the apparatus are heavy, I believe they would be still larger in nature. But the immense number of eggs attached to the lobsters that are brought to the market, which naturally would be destroyed, should be hatched and the fry reared for a short time, if possible, as either hatching alone or hatching and raising is better than destruction.

During the summer I have been experimenting here in hatching lobster eggs. I began work in the latter part of June, and the first eggs hatched on June 26. I have worked with only a small quantity of eggs, as the question was rather to find the best methods for working on a large scale next summer. By an accident to the supply-pipe only about 500 of the fry were left, but the possibility of the work was clearly proved. The largest of the fry is now about nine weeks old; they have molted five times, and measure about 21 millimeters in length and 3 to 4 millimeters in breadth across the broadest part. They seem to be healthy, and are very lively, and of greenish gray color. I still feed them on the soft parts of crabs.

I do not kill the lobsters, but simply get the spawn from the fishermen and exporters. I scrape it off with a small teaspoon, and very few of the eggs are injured. They are rather heavy, and consequently I give them a pretty strong current from underneath, just sufficient to keep them slightly moving. I have used unfiltered water this summer, but advise the use of filters, as the lobster eggs, being mostly in clusters, are very apt to become covered by the impurities in the water. The temperature in the water has been from 11° to 14° Réaumur, and the specific gravity from 1.021 to 1.025. The time necessary for hatching depends entirely on the state of the eggs when taken from the parent, and the eggs from the same individual will not hatch at the same time, but will differ as much as from three to four weeks. The apparatus used is one invented by myself for the purpose, and is connected with the apparatus used in hatching salt-water fishes.

FLODEVIG, near ARENDAL, NORWAY, *August* 26, 1885.

*For a previous letter on this subject see F. C. Bulletin, 1885, p. 280.

156.—RESOLUTIONS ASKING FOR THE ABROGATION OF THE FISHERY CLAUSE OF THE WASHINGTON TREATY, PASSED AT A CONVENTION OF NEW ENGLAND FISHERMEN WHICH MET AT GLOUCESTER, DECEMBER 27, 1884.

Whereas, the Government of the United States, by the treaty of 1818 with Great Britain, took from the fishermen of the United States the rights guaranteed them by the treaty of 1782 to fish in all the waters bordering on the coast of the British possessions in North America, excepting a small portion of the coast of Newfoundland and the Magdalen Islands, and the right to go upon the shores thereof for the purpose of curing fish, and the right to enter the ports of the British Provinces for the purpose of procuring supplies, and without either obtaining from the British Government any equivalent for the fishermen or making any compensation to them for the rights thus summarily taken from them; and

Whereas, this surrender of our rights has been a source of great annoyance and injury to our fishermen, and our vessels have been unjustly seized by armed cruisers for alleged violations of the stipulation of the treaty by which these rights were surrendered, and these vessels have been condemned in the colonial courts without legal authority, and that to an extent to make it unsafe for our vessels to pursue their legitimate voyages, therefore it is the duty of the Government of the United States at once to take such action as will protect the fishing interests and render it safe for the fishermen to pursue their lawful business; and

Whereas, the action of the Government of the United States, by the treaty known as the reciprocity treaty of 1854, and the Washington treaty of 1871, modified the rights of our fishermen and materially affected their interests, and in both treaties to their great injury, we heartily approve the action of the Government in terminating those treaties, and we are decidedly opposed to the making of any treaty with Great Britain having like provisions in relation to our fisheries. The only effect of the provisions of those treaties has been to damage our own interests and to foster and encourage those of the British Provinces; and the Government of the United States, instead of adopting a policy such as is pursued by all nations toward the fisheries, has taken from our fishermen that encouragement which for many years was given them by bounties and otherwise, and has brought our fishermen into an unjust competition with the fisheries of the British Government, which Government gives its fisheries a support which our Government withholds from ours: Therefore

We most respectfully request that the Government of the United States will take prompt action to restore to our fishermen the rights taken from them by the treaty of 1818, or provide for them a full and just compensation therefor, and that the Government will return at

once to its early policy of aiding and encouraging our fisheries, which all governments have found necessary, to secure their successful prosecution, and recognize the importance of this national industry.

NOTE.—The convention which passed these resolutions contained 160 delegates from nearly all the fishing ports along the New England coast. Benjamin H. Corliss was chairman. The committee on resolutions consisted of Slyvester Cunningham, of Gloucester; Oscar Comstock, of New York; O. B. Whitten, of Portland; T. B. Baker, of Harwich, and Luther Maddocks, of Boothbay. Letters of sympathy were read from Senators Hoar, Dawes, and Frye, and from Congressmen Collins, Morse, and Stone.

157.—SEGREGATION OF THE SEXES OF TROUT.

By LIVINGSTON STONE.

[Reply to inquiry of S. M. Crawford.*]

At or about the spawning season, it is customary for the two sexes of trout to segregate, the males collecting in one large body by themselves, the females doing the same, or, more correctly speaking, I think, being left to do the same, as the herding together seems to be more active on the part of the males. This continues for a considerable time, about the period of the spawning season, and is not the exception, but the rule. The same is true also of salmon, as is well known among salmon fishermen. It frequently happens that a whole run of salmon for several days will be composed almost entirely of males, the effect of which, of course, is to leave the females together by themselves, whether they take an active part or not in bringing about the separation. In fact, in hauling a seine frequently in a salmon river for some time, it is generally very noticeable that the sexes alternate in coming up the river about the spawning season, a large body of males being followed by a large body of females, and these by a run of males again, and so on through the season.

In the case of the trout mentioned in Mr. Crawford's letter, it is my impression that the males, in accordance with the custom just described, had separated from the females, and had retired to some other part of the lake (or stream), where if Mr. Crawford had fished he would have caught nothing but males. I suppose Professor Brooks would say that the preponderance of females was probably the result of an exceptionally favorable environment, but I am, nevertheless, very strongly of the opinion that there was the usual number of males in the lake (or stream), though Mr. Crawford did not happen to find them, and that no general preponderance of females actually existed.

CHARLESTOWN, N. H., *January* 12, 1885.

*Mr. Crawford, in a letter from Stark Water, N. H., January 6, 1885, says: On December 10 I began to catch the trout through the ice in six or seven feet of water, with a beardless hook. At first I caught males and then females, obtaining about 5 females to 3 males. Soon the male trout became more scarce, and of the 40 or 50 trout I have caught lately, I got but one male. The males I took at first I put in a large box with the females, and I have used the male trout until they are exhausted. Can you explain these singular facts?

Vol. V, No. 29. Washington, D. C. Oct. 9, 1885.

158.—HOW TO CATCH CARP.

By ROBERT A. MARTIN.

[From a letter to C. W. Smiley.]

The way to catch carp with a hook and line is just this: Let a person having a pond in which they are kept feed them with bread at a particular place, and when the fish have learned to come for such bread, let him get some good strong genuine Limerick hooks (not the American imitation of them), and tie them on strong oiled silk lines, on which lines there are corks, and bait with bread (bakers' bread, or any kind of bread that after pressing in the hand he can make stay on the hook), and throw out some two or three lines tied to good strong poles, one line on each pole, and very quickly he will have about the number of bites that he throws out baited lines. After hooking all the fish, he might hand all the poles except one to some person to hold, until he had worried down one carp; and after getting that one out, he might then work one by one on the remainder.

Three carp weighing from three to five pounds each ought to be enough for one day's sport and eating. They are very sharp and shy after one has been caught and played long enough to scare the others, and will stop biting for some hours afterwards. It takes a very good line and the best sort of a hook to hold them, and of course a good pole is also necessary. The genuine Limerick hook is, I think, hand-made. But little, if any, sinker is required, as the weight of the hook will sink the bait.

After being fed with bread (especially bakers', or what is called light bread, which will float on the water), it is best to fish shallow, say about one foot or one and a half feet. If they have been scared, then it will be necessary to fish deeper, say in two and a half or three feet. They bite best, of course, in the spring and fall months. They are the gamiest and best-winded fish I ever saw; and the only trouble is, that after catching some two or three the remainder will be scared off. This, however, could be partially overcome in a good-sized pond by the owner having some three or four places where he baited them, so that after they were scared at one place he could go to others, provided he was fishing both for sport and profit (in the latter case, catching them to sell).

As a pan fish they do not compare with our millpond chub or speckled perch, but they are good pullers. They bite quickly like a chub, and not like round-fish (a sort of mullet or sucker). The bread or bait of

course should cover well the barb of the hook. For carp weighing from one to two pounds smaller hooks of the kind named would be better. I wonder that more of our country people do not make ponds and raise the German carp. Properly cooked, they are very fair eating; but to one who loves a good, square, long-winded, honest pull by a fish, I do not know anything to equal them. If they are once hooked, one is sure to get them, provided he knows how to handle a fish and has good tackle.

PETERSBURG, VA., *January* 1, 1885.

159.—STRANDING OF A PIGMY SPERM-WHALE.

By JAMES R. HOBBS.

[From a letter to Prof. S. F. Baird.]

Surfman T. N. Sundlin found the fish, which came ashore 2½ miles north of the station during a gale of wind and a high tide, which caused it to be badly chafed. I sent three men with a horse and cart for it, but they could not put it in the cart. It was 9 feet long. The men pulled the fish upon the shore, and I had it covered with a light sail. On Sunday the gale abated, and I succeeded in carrying home the fish, which I identified as a pigmy sperm-whale. While the whale was on the beach the sail blew from off its head, and the birds picked out one of its eyes. The gale had injured the boat that runs here, so I boxed up the whale and in a small boat carried it a distance of five miles to a fish-boat and shipped it to Elizabeth City, N. C. Like all other fish of its kind, handling causes the skin to peel off.

KITTY HAWK LIFE-SAVING STATION,
Sixth District, North Carolina, January 1, 1885.

REPLY BY PROFESSOR BAIRD.

I have great pleasure in acknowledging the receipt yesterday of the specimen, the stranding of which you telegraphed me on December 26. I was much gratified to find it a specimen of the very rare pigmy sperm-whale (*Kogia*). The localities which this whale has been previously known to inhabit are the Gulf of California and the waters about Australia.

The specimen sent us by the life-saving service of Port Monmouth, N. J., a year ago, was the first ever known to occur in the Atlantic Ocean. Your specimen is the second, and fortunately is of a different sex—a male, which gives to us a complete history of the species. The animal you send is full-grown, and represents a group of pigmy sperm-whales, all of which are very rare.

WASHINGTON, D. C., *January* 6, 1885.

160.—SALMON AND TROUT HATCHERIES IN SCOTLAND.

By J. BARKER DUNCAN.

[Paper read before the Scotch Fisheries Improvement Association.]

(1) HOWIETOUN FISHERY.—This fishery belongs to the Earl of Lauderdale, Stirling. It was commenced in 1873. From year to year it has been extended and perfected so as to have gained a world-wide reputation as a fish-breeding establishment. Upwards of ten millions of trout ova are now annually incubated at this fishery. Last season no less than 90,000 yearling trout were delivered from it to all parts of Great Britain and Ireland. Two consignments of trout ova and one of salmon were also forwarded successfully to New Zealand. Loch Leven trout (*Salmo levenensis*) is the specialty of the fishery. American brook-trout (*S. fontinalis*) and common trout (*S. fario*) are also extensively cultivated. All eggs are eyed on glass grills, experience having shown that the strongest embryos and healthiest fry are obtained by this method. The normal period eggs take to hatch is found (with water at 44.1° Fahr.) to be as follows: *S. fario*, 71 days; *S. levenensis*, 72 days; *S. fontinalis*, 73 days; and *S. salar*, 77 days. Every twenty-four hours about one million gallons of water flow through the pond system of the hatchery, which secures thorough aeration. There are no less than thirty-two fish ponds at Howietoun, and one botanical, the latter being in course of completion. There are, besides, four ponds at Craigend; and one of nine acres at Goldenhove, which is used for rearing fish for the fishmonger. Very important experiments in hybridization are being conducted at the fishery. The staff required for the working of the establishment consists of a manager, three men, and four girls; and there are in addition constantly employed four laborers and at least two carpenters. Mr. J. R. Guy is secretary of the Howietoun Fishery.

(2) SOLWAY FISHERY.—This was established by its proprietor, Mr. Joseph J. Armistead, in 1881, superseding Troutdale Fishery, near Keswick, Cumberland, which was established in 1868. It is situated near the Solway, in Kirkcudbrightshire. Hatching on glass grills is also pursued at this fishery, the percentage of loss being thus reduced to a minimum. Mr. Armistead breeds at his establishment several kinds of trout, and char, salmon, and sea trout, grayling, and other freshwater fishes. The hatching house is capable of holding several millions of ova, and at present contains apparatus that will hatch about one million. A meat-house, ice-house, filter-house, and other buildings have also been erected; and these, with nineteen ponds in operation, and two in course of construction, occupy about an acre of ground. A museum and laboratory have been commenced to facilitate the study of the various details connected with the fishery. The ova and fry esti-

mated for distribution from the fishery, during the season just commenced, is something short of one million, including British and foreign, the bulk of the latter coming from Norway. Small, as well as large, quantities of ova are supplied from the fishery to enable amateurs to try experiments in fish-culture; and an illustrated catalogue of the apparatus required for conducting such experiments, and containing instructions, may be had on application by post. Mr. Armistead also supplies a list of aquatic plants as a suitable and most important adjunct of fish-culture; likewise proper food for trout, in the form of fresh-water shrimps, mollusks, fish meal for feeding fry, &c. Mr. Armistead's postal address is Solway Fishery, near Dumfries.

(3) STORMONTFIELD PONDS.—These ponds were erected in 1853 by the then proprietors of salmon fisheries on the Tay. They are situated about five miles above Perth, on that river, and occupy, roughly, about two acres of ground. Under Mr. Robert Buist, at that time the superintendent of the Tay fisheries, a long series of experiments was conducted, proving many interesting points in the life history of the salmon. These experiments—well known as the "Stormontfield Experiments"—demonstrated, not only the practicability, but the profitableness of rearing salmon artificially. The Stormontfield ponds are now superseded by the Dupplin hatchery (referred to below), but are still used for purposes of breeding and rearing. The breeding boxes number 360, and are placed in thirty parallel rows, in the open air, on a gentle slope. Of these boxes some 200 are being used the present season. They are laid with gravel. The present superintendent of the Tay fisheries, Mr. Alexander H. Lumsden, states that in his experience the percentage of loss is very great as compared with that under the new system followed at Dupplin. The two rearing ponds at Stormontfield have been stocked for this season with about 20,000 fry from the Dupplin hatchery, which are doing well, and are now parr about 2 inches long. The fry, fed on ground liver, are kept for about two years in the ponds before being turned out into the river and tributaries.

(4) DUPPLIN HATCHERY.—This new fish-breeding establishment of the Tay District Board is situated at Newmill, Dupplin castle (the property of Lord Kinnoull), Perthshire, on the river Earn, a principal tributary of the river Tay. It was instituted late in 1882. The hatching house is fed by spring water, at the rate of about 12 gallons per minute, which, however, is increased about a half more after the eggs are hatched. The gross hatching capacity of the boxes is estimated at 300,000. These are placed in four rows, fifteen being fitted up on the glass grill system, and five with the Wilmot tray, the whole at present containing, it is calculated, some thousands over the estimated capacity. It has been found that a much larger proportion of loss in eggs and young fish has marked the boxes with the Wilmot trays. But, on the other hand, about a third more of eggs can be laid in a box fitted with the trays, which is an advantage if ova is plentiful. An attend

ant in special charge of the hatchery keeps a daily account of loss in eggs and fry during the whole season. The loss for the past season amounted to $2\frac{1}{3}$ per cent. The number of days in hatching has been 64, on the average, the lowest number being 59; water temperature, 45 degrees. The fry are kept till about 40 days old, and then are distributed in the river Tay and its tributaries.

(5) LOCH LEVEN HATCHERY.—The hatching house in connection with the well-known Loch Leven fishery (Kinross-shire) was erected in 1883 by the Loch Leven Angling Association, Limited, assisted by the proprietor of the lake, Sir Graham Montgomery, Bart. The cost of erection was £229 19*s.* 2*d.* [about $1,115]. It is situated about 800 yards from the loch, beside a small stream. The water supply is got from a spring, about 600 yards from the house. With a temperature about 44 degrees, the period of hatching is from 66 to 72 days. There are 12 boxes—9 fitted up with glass grills, and 3 with Wilmot trays. Last season about 180,000 eggs were laid down. The percentage of failure was exceedingly small. The fry were strong and healthy, and were distributed in the spring months in the several feeders of the loch. This season, about 220,000 eggs have been laid down, under the superintendence of Captain Hall, who intends putting the fry into the loch tributaries five or six weeks after hatching. Prior to the erection of a special hatching house for the loch, Lord Lauderdale has, at different times since 1874, stocked it with Loch Leven fry and trout, bred at his own fishery.

(6) LINLITHGOW PALACE LOCH FISHERY.—This fishery was opened in May, 1884. It belongs to Mr. A. G. Anderson, fish merchant, Edinburgh, who has leased the loch for angling purposes from the Crown. A hatching house has been erected close by the loch on a small stream. Two ponds are attached—one for adult trout, and the other for rearing fry. A third and larger pond made of concrete is in course of construction, for stock purposes. The entire hatchery and ponds occupy about 2 acres. The hatching capacity is estimated at 600,000. For hatching, glazed terra-cotta troughs or tanks, and boxes covered with pitch, are used. The former do not give the same amount of space as the latter, in which are placed layers of perforated zinc trays—three or four to each box—thus providing a holding capacity of from 16,000 to 20,000 per box. Over 200,000 ova are already laid down for the season; but a large number of trout have still to be stripped. Last month 300,000 young trout, all strong and healthy, and measuring from $3\frac{1}{2}$ to $5\frac{1}{2}$ inches in length, were put into the loch. Mr. Anderson finds the eggs hatch out in about 62 days, at a temperature of about 45 degrees. Last season the loss in hatching was about 3 per cent. So successful has Mr. Anderson's hatchery been that he has erected another house—made of wood (50 feet long and 7 broad), covered with felt—with an estimated hatching capacity of 300,000. Young salmon hatched from the ova, taken from a dead fish killed by the salmon disease, have thrived remarkably well. There is also a tank of ova in the hatchery taken

from a female trout that had been twenty-four hours dead, and impregnated with the milt of a male fully four days dead. These eggs have now been in the tank for about three weeks, and are looking healthy—the loss at present being only 1½ per cent. A large arrival of Schoodic or landlocked salmon ova is expected at the hatchery from Washington, United States, and also a consignment of "Great Lake" trout ova from the Seewiese fishery, Wurtzburg, Germany.

(7) MARQUIS OF AILSA'S HATCHERY.—This private hatchery is situated at Culzean, in Ayrshire. It was commenced in 1876. In that year a few boxes only were erected outside the vineries in the gardens at Culzean castle, and put under the charge of the gardener. These boxes held about 85,000 salmon ova, which did pretty well; also 2,000 char; 2,000 *S. fontinalis*, and a quantity of common yellow trout. When the wind was high, however, it was found difficult to attend properly to the boxes outside owing to the rippling of the water—any bad eggs being, from this cause, not easily seen. In the following year, therefore, the boxes were fitted up anew in the peach house on a much larger scale. They are now capable of hatching out 250,000 salmon ova yearly. The ova is got from the Doon, Stinchar, and Minnock—the fish being artificially spawned when netted—and the fertilized ova thereafter conveyed in cans to the hatchery, a distance of 25 or 30 miles. For the last six years there have also been annually hatched 10,000 Rhine salmon. In addition, char, *S. fontinalis*, and Loch Leven trout, have been hatched annually, and introduced into the hill lochs on the property. The eggs are hatched on gravel, with a constant supply of pure water flowing through the boxes; and very satisfactory results have been obtained. The fry are turned out into the river Doon immediately on absorption of the umbilical sac, being conveyed in cans a distance of 10 miles from the hatchery, and put into the river about 8 miles from the sea. In two seasons, when ova was plentiful, over 300,000 ova were hatched. There are ponds in which the fry were at first kept till they were a year old, but these have been abandoned, as it has been found that the present practice of putting the fry out when the sac is absorbed is equally satisfactory. Mr. Young, the inspector of Scotch salmon fisheries, says in his second report, in which the Ayrshire salmon rivers are described: "Thanks to the enlightened liberality of the Marquis of Ailsa, the number of fish in the river Doon has been greatly increased by means of artificial stocking."

(8) BENMORE HATCHERY, KILMUN, ARGYLLSHIRE.—This hatchery was constructed by Mr. James Duncan, of Benmore and Kilmun, in 1874, after the plan of Stormontfield, for the purpose of stocking the river Echaig with a larger class of salmon. The results were very marked, not only in the greater number, but in the increased weight of the fish caught. Prior to the introduction of the hatching boxes, the grilse caught weighed about 3½ pounds—rarely exceeding 5 pounds, while salmon weighed about 7 pounds. After the introduction of the boxes,

grilse were seldom got under 5½ pounds, while the heaviest salmon caught in the river in 1882 weighed 18 pounds. In Loch Eck, out of which the Echaig flows, fish weighing nearly 30 pounds have been taken with the net. The capacity of the hatchery is 100,000 ova. In the season of 1882, 80,000 young salmon from Tay and Tweed ova, after the absorption of the umbilical sac, were turned into the river and tributaries. The boxes are filled to within a few inches of the top with coarse gravel, a layer of finer gravel above forming the bed for the ova. The loss has not exceeded 5 per cent. The hatchery has been idle for two seasons, it being questionable if any permanent benefit can be had in the attempt to stock small rivers on the west coast at present.

(9) LOCHBUY FISHERY, ISLE OF MULL.—This fishery was established in 1878. It is the property of Maclaine of Lochbuy. Upwards of 50,000 ova of salmon, sea and other varieties of trout (*Salmo fontinalis*, &c.), are annually hatched. The proprietor every year imports eggs from Norway, Germany, Austria, and America. There are large ponds for the reception of fry and for keeping breeding stock. The specialty of the establishment is the breeding and rearing of salmon and sea trout (spawned from the wild fish caught in the rivers on the property), for the restocking of the rivers and lakes on Lochbuy estate for sporting purposes. Large sheets of water on the estate, which were utterly untenanted by fish, now teem with splendid varieties, and afford magnificent sport to the angler. The proprietor not only stocks his own waters, but also sells ova, fry, or grown fish.

(10) ABERDEEN HATCHERY.—This hatchery was established in the end of 1863 by the district boards of the rivers Dee and Don, and has been under the experienced management of Mr. Alexander Adam, manager of the Aberdeen Salmon Company. It is erected in the fish house of the salmon company, where a quantity of ice is always kept. The average time of hatching is 107 days. There are 13 boxes made of slate laid in with gravel. From 15,000 to 20,000 are hatched out every year. The fry are distributed in the rivers Dee and Don as soon as the umbilical sac is absorbed. The average loss in hatching has been found to be about 7½ per cent. The fry are taken up the rivers from 10 to 20 miles, sometimes as far as 40 miles, in pails, and, by using a little ice on the way, the temperature of the water is kept down.

(11) THE MORISTON HATCHERY, INVERNESS-SHIRE.—This hatchery was erected in 1878 on the property of J. R. J. M. Grant, esq., of Glenmoriston, for the purpose of stocking the river Moriston with salmon. The Moriston was not accessible to salmon until a pass was formed, a few years ago, at the falls, near Loch Ness. The hatchery is situated 3 miles above the falls on a tributary of the river. There are 40 boxes laid with gravel, each large enough to receive 1,000 salmon ova. Neither the glass grill system nor the Wilmot tray has yet been tried. An average of about 30,000 fry were turned out in each of five

years; the fry from the hatching of the spring of 1883 only being turned into a temporary pond, where they were kept until they were a year old. A few salmon are seen every year ascending the pass into the river, which is strictly preserved, it being thought desirable not to disturb the water yet, either by rod or by net, for the purpose of sport or of collecting ova. Mr. Grant is anxious to make the Moriston an early fishing river, and, with this view, takes ova only from other early rivers. Some of the proprietors of these rivers in the neighborhood are averse to disturbing their waters for the collection of ova, and the fishery boards, in the absence of unanimity on the question, do not see their way to give authority to take ova, as they doubt whether they have the power to do so under the present law; consequently, the hatchery has not been filled during the last two spawning seasons.

It appears that the Duke of Sutherland's hatchery at Loch Brora, Sutherlandshire, and the Duke of Buccleuch's ponds at Drumlanrig, Dumfriesshire—the latter so celebrated in connection with the experiments and observations conducted there by Mr. Shaw, bearing on the life history of the salmon in its early stages—are not at present in operation. Information has been sought, but not obtained, regarding the artificial ponds which were at one time kept on the river Thurso; so that it is not known whether these ponds are still used. The same remark applies to the ponds which were, at one time, kept at Invershin, Sutherlandshire, by Mr. Andrew Young, whose name ranks with those of Shaw and Buist as a close observer of the early life history and migrations of the salmon. The hatchery formerly kept at Rossdhu, Loch Lomond, has, it is understood, fallen into disrepair, not having been used for a good many years. The two ponds, however, still remain, and, as boxes could be erected without much expense, this little establishment might, with very little trouble, be resuscitated. At Ravenscraig Castle, on the river Ugie, Aberdeenshire, a set of hatching boxes at one time was maintained. It was considered, latterly, that the Ugie fishing was not much benefited by the operations conducted. A hatching establishment existed at Tongueland, on the river Dee, Kirkcudbrightshire, for some eight or nine years prior to 1871, but, after the death of the then tenant of the fishings, Mr. John Gillone, it appears to have been allowed to drop. His sons, however, it is understood, contemplate its revival. The district board of the South Esk (Forfarshire) placed a few breeding boxes on a tributary of that river a good many years ago, but these apparently did not succeed and do not now exist.

It is not pretended, however, that this reference to hatcheries and ponds that have once been in operation, by any means includes all that have existed in modern years in Scotland; as it is believed that many private individuals have, at different times, made experiments in fish-culture on a larger or smaller scale.

EDINBURGH, SCOTLAND, *November* 26, 1884.

161.—THE FISHERIES OF MALTA.

By JOHN WORTHINGTON, Consul.*

[Dispatch No. 142 to the State Department.]

The governor of Malta, in a communication relative to the Maltese fisheries, transmits a report on fish-culture, made by a board appointed by the government to report on the fishing regulations of Malta, and also a report made by Professor Gulia on the same subject. These reports I herewith transmit. The governor expresses the hope that Professor Baird will find in the reports inclosed sufficient information to enable him to afford to the fish board and the Maltese people information on the culture and preservation of the fish of Malta, which will be of interest and value to all concerned here. The fish question is a very serious one, as year by year the supply has been falling off and the prices increasing, until now the poorer classes of Maltese can seldom afford to indulge in the food that ought to be cheapest and best in these markets.

The nature and character of the currents and bottoms of the bays and coasts of the Maltese Islands are, I believe, well explained in Lieut.-Commander Henry H. Gorringe's book, entitled "Coasts and Islands of the Mediterranean Sea," Vol. III, published at the Government Printing Office, Washington, in 1879. The portion of the volume that treats on Malta begins at page 83.

UNITED STATES CONSULATE,
Malta, August 23, 1885.

REPORT ON THE FISHING REGULATIONS OF MALTA.

The complaints made generally by the several fishermen, principally owners of ground seines ("tartanoni"), in regard to the regulations published on November 14, 1873, seemed to apply especially to the paragraphs following each of the articles 1, 2, and 6, prescribing certain additional limits to that kind of fishery from April to July, inclusive; and also to the interdiction of certain nets, which will be specified hereafter, and which, as they asserted, caused no injury to the bottom of the sea and captured no fish before maturity; whereas, on the other hand, the use had been conceded of certain instruments which they said were highly objectionable because of their disturbing the bottom of the sea and capturing multitudes of young fish and driving them away from our ports.

Having thus determined the nature of the complaint, our next duty was that of considering attentively the regulations, for the purpose of

* See also page 400 of this volume.

ascertaining whether the above-stated complaints were well grounded, and, if so, to suggest what, in our opinion, would reconcile the interests of all parties, and whether any measure could be adopted in furtherance of the very laudable object principally kept in view in framing the regulations, namely, the increase of this important article of food.

With regard to the restriction to fishing in certain localities from April to July, inclusive, we beg to state that, keeping in view the object of the regulations (namely, that of preventing the capture of fish before their development is attained), inquiries were made in certain disinterested quarters as to whether, in the localities referred to, fish were ever captured as stated, inasmuch as the fishermen themselves maintained that young fish do not seek any great depth of water. From these inquiries we learn that practical men support our views, namely, that during the above period young fish from shallow waters retire to deeper ones in order to repair to a cooler temperature; and that, moreover, it was the presence of young fish in these and similar localities which attracted in considerable numbers to our ports and all around our coasts schools of migratory fishes, such as mackerel ("pizzintun"), pelamid ("palamit"), and germon ("alonga"), which used to visit our seas in great numbers, but which now are of unusual occurrence in these waters.

The lessening in numbers, moreover, of the non-migratory fishes (namely, those that are hatched, grow, and fix their abode in our ports or along the coasts of these islands), such as the wrasse, the sea-bream, the gray mullet and red mullet, the bass ("spnott"), and other fishes which are in esteem for the table with us, is daily becoming more evident.

Under the circumstances, we are compelled not only to admit the reasonableness of the restriction in question, but also to express our hope that in course of time these nets will be entirely prohibited. Indeed, nothing short of such a measure, which we understand was lately carried out in Sicily, will succeed in putting a stop to the immoderate and incessant capture of fish, which capture is so detrimental to the interests of all parties. Still, the extreme poverty of the seiners, who are above forty in number, and their ignorance of any other trade, induce us, on the other hand, to hope that they may be allowed to use their nets as prescribed in articles 1, 2, and 6, without subjecting them to the additional restriction contained in the paragraphs following each of those three articles; on condition that their instruments be at once seized on their infringing any of the articles referring to ground seines in the regulations, and, moreover, that the license be granted only to them personally, so as not to increase their number, by which measure the Government will be enabled, when in course of time their number is extinct, to prohibit these nets altogether in the principal harbors.

With regard to the second complaint, relative to the prohibition of certain nets technically called "ghazel tal sardin," "ghazel tal lacci," and "terrieha tal xilep," we beg to state that as their use is limited to

certain seasons for the capture of migratory fish, and considering both the largeness of their meshes, which does not admit of young fish being captured, and the circumstance of their hanging down curtain-like through only half the depth of the water in certain localities, or even when reaching the bottom their causing no injury to the spawn that might possibly be found at the bottom of the sea, we are of opinion that their use can be allowed without prejudice to the multiplication of fishes.

The last complaint refers to the objectionable use of the trawl-net ("gangamo"), as it disturbs the bottom of the sea; to the use of the net known generally under the name of "mendila" on account of its small meshes; and to certain oval-shaped rush traps technically called "nassi tal mulett," or "nassi tal ghalf," whose meshes being very small, and baited as they usually are with biscuit-dust and rancid cheese, and laid in shallow water and at the mouths of sewers, attract and capture great numbers of fishes, some of which are only half an inch long. The havoc made being so evident, we do not hesitate to recommend their total prohibition and that a severe penalty be inflicted in case of their use.

This complaint refers also to the trammel-net ("parit") being allowed to be cast in any locality within the harbors. As it is generally admitted that these nets frighten and drive away the fish from our ports, we recommend that they be prohibited altogether inside the Great Harbor and Marsamuscetto and opposite the entrance to these places to the distance of half a mile, and that their use, together with that of the net called "tond tal plamti" in other localities, be granted by an annual license subject to such restrictions as may be deemed proper.

In order to further one of the most important objects of the regulations in preventing the capture of young fish, we recommend that an article be added, visiting with a severe penalty any one found in possession of such fish (commonly called "torbia"), and authorizing their seizure on discovery. In order to facilitate the execution of such a regulation, we append hereto a list of the non-migratory fishes with the respective length under which the fish are to be regarded as "young."

List of fishes considered young when less than the length respectively specified.

Kind.	Length.	Kind.	Length.
	Inches.		*Inches.*
Sea-perch ("burkax")	3	Red mullet	3
Bass ("spnott")	5	All sea-breams, such as the bogue ("vopa"), the common sea-bream ("sparlu"), and the gilt-head	3
Comber ("sirian")	3		
Dusky perch ("cerna")	5		
Stone-bass ("dott")	5	Gray mullet ("mulett")	4
Dentex ("dentici")	4	Wrasse ("tird")	3
Mendole or cackerel ("xurraf")	3	Rainbow-wrasse ("gharusa")	3

VALETTA, MALTA, *April* 29, 1874.

REPORT FROM DR. G. GULIA.

Mr. S. Cachia Zammit states that by permitting the use of the trawl-net called "gangamo" and the casting net called "terrieha" in certain localities, and by extending the area of the seines ("tartanoni"), he has reason to believe that several fishermen would not be satisfied. He may be right, for fishermen are seldom satisfied with what is granted them, especially when they are induced to believe that all restrictions in fishing are vexatious and useless, and that all the machinery of capture should be allowed without any limitation of time and space.

Since the publication of the fishing regulations, some ten years ago, the use of the "parit," then an unlawful net, was granted them outside and inside the harbors, even on prohibited areas, with very slight restrictions. The use of the net called "mendila" was also conceded on this area to procure shrimps for bait. Shrimping is now carried on in Marsascala and in Marsascirocco chiefly by women. The surface nets called "ghazel tal lacci," and some kind of rush nets ("drajen"), were also granted. Fishermen here now asked for the "gangamo," and with the view of furnishing them with more shrimps I have recommended, not without some degree of hesitation, that its use may be granted in certain localities, for the number of anglers having lately increased, the supply of shrimps, which constitute the chief bait for the anglers, became insufficient. This fact induced me to advise the government to grant licenses for the use of the "gangamo" or beam-trawl net, which has always been an unlawful net, even, I believe, in the time of the Grand Masters.

Speaking on the various implements of fishing, Mr. Holdsworth, secretary to the royal sea-fisheries, in a very interesting work on fishing (London, 1874), writes: "It is well known that the beam-trawl net (gangamo) is a ponderous instrument which hashes the fish that it captures and destroys a large number that it does not capture." All this is well known to our fishermen. I could not, therefore, recommend to the governor the use of such an instrument without restriction. Notwithstanding that the fishing regulations are now reduced to very slight restrictions, I would not be surprised if after the new licenses other petitions should be presented to the governor for further concessions, namely, the use of "tartanoni," "terrieha," and "gangamo" in all localities. But by allowing the use of these nets there would surely follow a decline, perhaps a complete destruction of most of the non-migratory fishes.

Some supply of fresh or brackish water which empties into the sea seems to be of importance to the health and growth of some sorts of marine creatures. Such bottoms, which are always muddy, are covered by a grapwrack called *Phucagrostis major* ("harira"), and is more or less supplied with eels, gray mullets, prawns, shrimps and other crustaceans, and mollusks, besides other marine productions suitable for

the wants of the younger fishes, especially in the sheltered bays of Misida, Marsascala, and Marsascirocco, where the *Phucagrortis* occupies a large area. These bottoms are called "ghejun" by the Maltese. To these grounds most of the gray mullets run up to deposit their spawn, and when hatched the young fish remain several months on the same bottoms to attain their full growth, and on these grounds the gobies ("imzazen") build up their nests.

With the view of preventing these fish from being improperly destroyed, and of protecting especially spawning and immature fish, the use of the above-mentioned destructive nets was prohibited on such areas so munificently supplied with animal life. When such implements are drawn along the bottom, the *Phucagrortis*, which is very brittle, is broken in fragments, which by their decomposition give off gases inimical to animal life; stones are removed under which small fish seek concealment and safety; the mud is disturbed, rendering turbid the water, which thus becomes unfit for the maintenance of animal life; a considerable number of the fish are caught and others are destroyed; the nests of gobies with their contents are disturbed; and thousands of invertebrates, which constitute the chief food of the fish, are also destroyed by these nets.

I cannot conceive how Mr. Zammit could have gone so far as to assert that he does not believe in the possibility of destroying the spawn and small fish by any existing method of fishing. He quotes authorities and facts which are not applicable in our case, for Professors G. O. Sars and A. W. Malm (1876) refer to the fisheries off the coast of Norway, where most of the esculent species in special demand (as the cod) do not deposit their spawn on the bottom, but drop it in the water at a considerable distance from the bottom.

It is also well known that the mackerel spawn ("cavall") is specifically lighter than sea-water, and that consequently it floats on the surface like that of the cod. I attribute the fluctuation in the reproductiveness of this species, which ten years ago was caught in great shoals, and which is now seldom seen in our markets, to the facility with which its ova can be destroyed either by fish or birds. From these facts Mr. Zammit deems himself authorized to establish general rules and consider useless all fishing regulations. "There is no doubt," says Mr. Holdsworth, "that if some species spawn on the surface, others spawn at the bottom of the sea." I refer Mr. Zammit to the works of my friend Prof. A. Costa, of Naples, who has given full details of the favorite places of fishes for depositing their spawn, with the view of showing him that his conclusions are not based on scientific observation. I have never seen floating eggs in the harbors and creeks of Malta, or aquatic birds preying on them, during 26 years of careful investigations, especially in the Bay of Marsascala. I do not believe that there are any good grounds for complaining that the above-mentioned nets should

remain unlawful in the localities covered by the *Phucagrortis*. It is a prohibition that does not aggrieve fishermen, for the fisheries on these small areas are not remunerative; on the contrary it does good, for it protects the fish from being caught before maturity, and when mature they are more readily sold in the markets. I hope that Mr. Zammit will be fully convinced that the government is protecting the multiplication of our non-migrating species, on scientific and practical principles. Mr. Holdsworth remarks that "we should fish with economy, and above all we should fish in such a manner as will not wantonly waste the spawn of our best table-fishes. At present the waste of spawn is so enormous as to be incalculable, which may be said of all fishes, even of those which we least esteem for food purposes."

The "gangamo," the "terrieha," and the "tartanoni" will soon be allowed indiscriminately on bottoms called by fishermen "trix," which signifies rocky bottoms with occasional sands often covered by the *Caulinea oceanica* ("alca"), such as all the bays of San Paolo a Mare, Birzebbugia, and all other creeks and bays having such bottom. I have advised that the area for the seines should be extended all over the rocky bottom ("trix") of Marsascala, Marsascirocco, and San Georgio. I have also suggested that licenses shall be given for the use of the "terrieha" in all localities where fisheries with the "tartanoni" can be practiced. I foresee that some amateurs, who fish both for amusement and profit, will probably push fishermen to ask the governor to make lawful the use of the "terrieha" on the areas of the *Phucagrortis;* but as I have already expressed my opinion on the subject, I do not deem it necessary to repeat that on similar bottoms the use of this net should remain prohibited.

As regards deep-sea and coast fishing, there are no restrictions whatever. I would recommend the governor to encourage as much as possible deep-sea fisheries, for in deep waters fish are obtained in large quantities and of good size. I believe that the boats and especially the implements of our fishermen are unsuited to the pursuit of the immense shoals of fishes that abound in the Mediterranean. I would, therefore, respectfully advise the governor to appoint a commission with the view of extending and improving our fisheries and fishing gear. When Sicilian fishermen, furnished with valuable machinery of capture, come to our waters, at a considerable distance from the coast, they catch great quantities of fish, and our markets are then fully supplied with the best species of the Mediterranean.

With the purpose of furnishing anglers with more bait, I would recommend the government to give special permission for fishing for marine worms and other invertebrate animals in places where such fishing has heretofore been prohibited.

JULY 14, 1884.

162.—A DESIRE FOR FISH-CULTURE IN MALACCA.

By LEONARD WRAY.

[From a letter to Prof. S. F. Baird.]

You may be somewhat surprised to find that the subject of fish-culture is of considerable importance even to this small Malay state, but such is really the case; I refer, however, solely to those fish which will live and breed in the many rivers and mountain streams of this peninsula; to freshwater fish, in fact. Personally I am more interested in mountain streams and sheets of water, at from 2,000 to 3,000 feet above sea-level, which have a temperature ranging from below 50° Fahr. up to 75° Fahr. in the middle of the day.

Among the many fish that I wish to establish in this state, if possible, are the American whitefish (which I see are now being incubated in England) and the shad, of which I perceive you have bred and distributed over 30 millions of young fry. We have in Calcutta an abundant supply of a shad termed "hilsa," which seems, if not identical, at least nearly so, with the United States variety. I have eaten numbers of them, both in America and in India, and I fancy your shad is the thicker fish. The questions arise: Can we in any way manage to get the fecundated ova of this delicious fish? And will they breed and thrive in our streams? If any competent person in India would undertake the matter, no doubt we could get any amount of ova sent down here in ice; but at present I know of no one in India who even dreams of fish-culture. Must the shad of necessity go periodically to the sea or can it be "educated" to put up with a freshwater life altogether?

Have you in the grand rivers and lakes of the United States any true mullet which will thrive wholly in fresh water? I fancy that there are purely freshwater mullets in the upper rivers of India; but it is now so many years since I lived in those parts that I cannot be certain. One of the great delicacies of Jamaica is the mountain mullet, but I cannot imagine how to get the ova here in good condition, as a letter just received took 42 days in transmission from that island to this place. I must try to accomplish it by the aid of the National Fish Culture Association of England, and they may be able to send me the American shad also.

STRAIT OF PERAK, via PENANG, MALACCA, *June* 25, 1885.

REPLY OF PROFESSOR BAIRD.

Although it is not entirely impossible, with a suitable expenditure of money, yet it would involve much uncertainty of a satisfactory result to attempt to transfer a fish from the United States to Malacca. The two difficulties in the way are the distance to be traveled and the temperature to be encountered. The shad is very difficult to transport,

being very delicate and sensitive to extremes of temperature. In the present state of our knowledge, it would be impossible to carry the eggs that distance; and until we can succeed in transporting the eggs or very young fish to England, we may safely give up any more ambitious attempt. There would be no great difficulty in transporting the eggs of the trout from England to India. They could be packed in ice, which, if renewed from time to time on the journey, would keep them in proper condition. We have several times sent salmon eggs to Australia and New Zealand with excellent results. Whitefish eggs, also, could be sent; but this fish will survive only in deep lakes of cold water, where the temperature does not rise above 50 or 60 degrees Fahr.

We have no purely freshwater mullet in the eastern United States. There are, however, several species in the West Indies, and one in the Sandwich Islands, which are strictly freshwater in their character; although I doubt whether they would be better than those you can obtain nearer home.

WOOD'S HOLL, MASS., *August* 13, 1885.

163.—THE USE OF THE ELECTRIC LIGHT IN FISHING.

By LIEUT.-COMMANDER Z. L. TANNER, U. S. N.

[Reply to Oscar Hatfield, U. S. Consul at Batavia.]

I have received the letter from the American consulate at Batavia, dated July 10, 1885, with reference to the use of electric lights for fishing.* In reply I beg to say that electric lights are in constant use on board the Albatross in our work of investigations. We have used an arc light hung near the water, but the form in use at present, which has been most successful, is an Edison incandescent lamp attached to an insulated cable. Although certain species of fish in rivers, and near the coast, are attracted by a bright light, sea fish, as a rule, are rather repelled by it than otherwise. We do not use the light for the capture of edible fish, but only in collecting minute forms of crustaceans and surface specimens which we could not procure by any other means. My opinion is that the electric light would be of very little service in sea fishing.

WOOD'S HOLL, MASS., *August* 25, 1885.

* The letter was as follows:

"Some time ago a company was started here for the purpose of fishing by electric light. A variety of apparatus, &c., was ordered and received from Europe, a steamer was especially constructed, &c., but the company cannot catch any fish. The result is an apparent failure and the loss of the funds invested.

"It appears, however, that at home your department maintains a steamer called the Albatross, on which an electric fishing apparatus is in good working order, and I have been asked by the company here to ascertain if this is so, and if so, they would be very much indebted for information regarding it. What system or patent is worked? Where can it be purchased? Any hints upon the subject will be thankfully received."

Vol. V, No. 30. Washington, D. C. Oct. 13, 1885.

164.—NOTES UPON FISH AND THE FISHERIES.

Compiled by CHAS. W. SMILEY.

[Mainly derived from the official correspondence.]

BLACK BASS IN GERMANY.—Max von dem Borne, writing to Mr. Fred Mather from Berneuchen, August 18, 1885, says:

"Perhaps you will recollect that you recommended to me the introduction of black bass into Germany. In 1882 I received some of these fish, when Mr. Eckardt returned from America. I am pleased to say that the fish multiplied abundantly. I had 1,200 in the fall of 1884, and have caught more than 22,000 fry this season."

ZIZANIA AQUATICA FOR GERMANY.—A request having been received from Max von dem Borne, of Berneuchen, Germany, for some seeds of the freshwater rice (*Zizania aquatica*), a package was forwarded by Howe's Express, April 1, 1885, in behalf of the United States Fish Commission.

RAISING BLACK BASS, SILVER BASS, AND CROPPIES TOGETHER.—Mr. William L. Leonard, of Winterset, Iowa, writes, August 28, 1885, that he is highly delighted with his success in cultivating black bass, silver bass, and croppies all in the same pond. The black bass hatched a fine lot of young, and the silver bass which were put in late in the season hatched a few young. He proposes to put blue catfish into his carp pond.

WORK OF THE MAINE COMMISSION.—Mr. E. M. Stanley writes from Bangor, Me., January 20, 1885, as follows:

"The Penobscot should have at least 1,000,000 salmon planted in it every year. The only proper system to do justice to our work, to the cause, and to ourselves, is never to plant less than half a million for several successive years in any river to be restocked. But legislators make demands upon us, and as we must have votes, we dare not always refuse to scatter the plants. Our only hatchery capable of carrying a million of eggs is at Enfield. The one at Norway we hire, as also at Weld. At Norway we hatch the eggs for the Saco River. At Weld we hatch 200,000 for the Kennebec and the Androscoggin, as also 50,000 landlocked salmon eggs for Webb's Pond, in Weld. At Rangeley we hatch 50,000 landlocked salmon eggs for Rangeley Lakes. At Moosehead Lake we hatch 100,000 landlocked salmon eggs for that lake. At Enfield I reserve only some 20,000 landlocked salmon eggs for two or three small waters where we dare not refuse."

BIG-EYED HERRING TAKEN IN THE POTOMAC.—On the 28th of August, 1885, Mr. R. A. Golden exhibited at the National Museum a big-eyed herring (*Elops saurus*) which had been taken near the mouth of the Potomac River. It weighed 3½ pounds. Being the first that he had seen from these waters, he was unable to name it without assistance.

THE ALBATROSS WORK HELPFUL TO FISHERMEN.—Captain Collins writes from Gloucester, August 24, 1885, to say that the researches made by the Albatross on its late cruise to the eastern fishing-grounds are much appreciated by the New England fishermen. Capt. Thomas Thompson, who is engaged in the fresh-halibut fishery, desiring to find Hope Bank, was greatly aided by information obtained as to its locality and the knowledge that there were about 2,000 fathoms of water where Hope Bank had been located. But for this he would probably have wasted three or four weeks in looking for it.

THE WHALE FISHERY.—Mr. James Temple. Brown, who has been collecting information at New Bedford during the past few weeks, states, under date of August 27, that the present arctic season opened favorably, many of the vessels being in Behring Strait before the whales made their appearance. One vessel had killed 9, another 8, others 7 whales each. The tender of the arctic fleet arrived at San Francisco August 24, with 110,000 pounds of whalebone, valued at $2.75 per pound.

THE AMERICAN REPRESENTATION AT THE NAPLES ZOOLOGICAL STATION.—The representative from this country is Dr. Charles S. Dolley, who left the United States October 23, 1884, for the purpose of entering upon his work at Naples January 1, 1885. He was sent by the University of Pennsylvania, and is the only American at present studying at Naples, Williams College having relinquished the table formerly occupied by Professor Clarke.

CALIFORNIA SALMON SUCCESSFUL IN AUSTRALIA.—The Forest and Stream, of January 8, 1885, says that owing to the persistent energy of Sir Samuel Wilson, who has continued his efforts at introducing salmon for a number of years, it is now believed that the introduction is successful, a number of fish having lately been caught in the river Yarra-Yarra near Melbourne, which are believed to be California salmon.

OYSTER CULTURE IN A WOODEN TANK.—Mr. Fred Mather, writing from Cold Spring Harbor, August 31, 1885, says: "I have made a success of oyster culture in a wooden tank, 12 by 6 feet, with water pumped from the harbor. I have sets on shells and gravel four weeks old that are one-eighth of an inch long. The experiments were made under the direction of the New York oyster commissioner, Mr. E. G. Blackford."

HATCHING TOMCOD.—Mr. Mather writes, January 11, 1885: "Our tomcod are hatching splendidly; the water is clear and free from sediment; density, 1.021 to 1.022. We have stopped the springs from leaking into the pipes and bringing in sediment and 'bog-ore,' which left a ferruginous deposit on everything last year."

TERRAPIN CULTURE IN NORTH CAROLINA.—The commissioner of agriculture of North Carolina, Mr. Montford McGehee, writes from Raleigh, August 20, 1885, that several citizens along the coast purpose breeding terrapins for the market.

NOTE ON TROUT CULTURE.—March 20, 1885, Mr. M. T. Peebles was furnished with 50 California trout from the Wytheville hatchery. Under date of June 10 he states that the fish have made wonderful growth during the two months past, having more than doubled in size. He has an ample volume of clear cold spring water which will sustain 500 trout with very little feeding.

BREEDING GOLDFISH.—Mr. Henry W. Elliott, writing from "Rockport Cottage," Cleveland, Ohio, September 14, 1885, says that his 25 goldfish, which he put into his pond last April and which were then only 3 inches long, have grown to 8 inches in length, and produced thousands of young, so that the pond is fairly alive with them. Some of the young fish are nearly 6 inches long already.

BREEDING JAPANESE GOLDFISH.—From two pairs of Japanese goldfish received from the United States Fish Commission last winter, Mr. J. D. Yerkes has from 500 to 1,000 little fan-tails hatched this summer. [Letter of Frank N. Clark, September 21, 1885.]

THE ARRIVAL OF CATFISH IN BELGIUM.—Under date of Ghent, January 2, 1885, Hon. Alfred Lefebvre, United States vice-consul, wrote that of the 100 catfish forwarded November 15, 1884 (see page 84), 93 were still doing well, only 2 having been lost since they were placed in the aquarium. He says: "Hopes are entertained for the complete success of the scheme thus inaugurated by Mr. Wilson."

AN OPINION OF THE SOLE.—Referring to the recent effort of the U. S. Fish Commission to introduce the sole from Europe, Mr. William Stowe, the president of the Gloucester Net and Twine Company, of Boston, says: "I regard it as being worth to us as a nation all the money the Government has spent on it. In England I had sole for every breakfast. It is the best tasted fish that swims."

CAPTURE OF A YOUNG BLACKFISH.—December 30, 1884, Mr. J. G. Fisher, keeper of the life-saving station at Provincetown, Mass., captured and forwarded a young blackfish.

SALMON AND TROUT IN SCOTLAND.—Mr. John Anderson, writing from Glasgow, December 6, 1884, says: In the River Tay last week, while capturing salmon for our hatchery, we caught a large fish weighing no less than 80 pounds, the finest and largest salmon ever caught in Scotland. It was a clean-run fish from the sea. Six years ago the largest salmon caught in the Tay weighed 40 pounds; three years later the highest weight was 60 pounds; next year, 65; and last year, 76 pounds.

The Loch Lomond Angling Association is trying to restock this queen of the Scottish lakes with the best finny tribes worth an angler's attention, and to keep every stream free from pollution.

SHELL-FISH WANTED FOR UTAH.—Mr. B. S. Yaeger has a salt-water lake at Goshen, Utah, in which he proposes to try oysters, shrimps, crabs, &c., from the Atlantic Ocean. The lake is half a mile wide and a mile long. The water being as salt as that of the ocean, he thinks there is good probability of success.

COREGONUS ALBULA EGGS FROM GERMANY.—By direction of Herr von Behr 50,000 eggs of *C. albula* were started on the 11th of January, 1885, from Berneuchen, Germany, for the U. S. Fish Commission. The eggs were packed by Max von dem Borne and addressed to the care of E. G. Blackford, New York City.

The eggs arrived in New York by the steamer Werra, on Saturday, January 24, and upon being opened at Cold Spring Harbor by Mr. Fred Mather, were found to be in good order. Mr. Mather was instructed on January 31st to repack and forward the eggs to Mr. Charles G. Atkins. February 3d Mr. Atkins reported their safe arrival at Bucksport, Me.; but on the 6th he added:

"Mr. Buck reports 1,417 of the whitefish eggs (*C. albula*) dead on unpacking, and some others apparently in bad condition. Evidently, as a whole, the invoice is not in as good condition as I supposed when I first opened it."

Mr. Atkins was instructed to hatch the eggs, and plant the fish under the directions of Hon. Eugene Hale. July 10th he reported the results as follows:

1885.			
Feb. 3.	Received eggs of *Coregonus albula* in fair condition		50,000
	Dead on unpacking	300	
	Subsequent losses	9,700	
April —.	Liberated in Heart Pond, Hancock County, Maine	15,000	
24.	Liberated in Lake Hebron, Monson, Piscataquis County, Maine	25,000	
			50,000

DISTINGUISHING THE SEX OF CARP.*—There are two methods for distinguishing the sex of carp which I have tried, and in which I place considerable reliance. They are:

(1) By their heads. The head of the male carp is a little shorter,

* See F. C. Bulletin, 1885, p. 37.

narrower, and more pointed than that of the female, while the female is a little more dish-faced.

(2) By "stripping" or squeezing the genital parts. The male fish always has more or less milt in the duct leading to the genital opening, and a slight pressure with the thumb and forefinger will bring some milt to the surface at any season of the year. If the fish is a female no effect will be produced, as the eggs will not be emitted unless ripe and detached, or partly so, from the bulk of the spawn. I think that this "stripping" will do no injury, unless it is so violent as to bruise the fish.

I have never tried to distinguish the sex of carp less than one year old, and do not think that it can be done. Nor have I experimented in determining the sex of other varieties of living fish. [Kemp Gaines, Springfield, Ohio, January 27, 1885.]

165.—REPORT OF HATCHING OPERATIONS AT COLD SPRING HARBOR, N. Y., DURING THE SEASON OF 1884-'85, AND THE DISTRIBUTION IN THE SPRING OF 1885.

By FRED MATHER.

(*a*) SALMON (*Salmo salar*).—Two lots of eggs, each containing 250,000, were received on January 15 and January 22, 1885, in good condition, from the station at Bucksport, Me. There were 2,310 dead eggs on unpacking, and 5,204 died before hatching. Of the fry there was a loss of 68,124 before planting. The disposition of the remaining 425,000 will be found in the appended table. One hundred and fifty yearling salmon, from 4 to 6 inches long, were planted in Clendon Brook, Warren County, New York, near Glen's Falls, where a plant of fry was also made in 1884. Mr. A. N. Cheney, of Glen's Falls, writes that the fishermen report this brook as being "alive" with young salmon; and he has promised to send specimens.

(*b*) LANDLOCKED or SCHOODIC SALMON.—Received from Mr. Charles G. Atkins, in charge of the station at Grand Lake Stream, Maine, 60,000 eggs on March 19, 1885, in excellent order; 45 dead on unpacking. The total loss of eggs in hatching to April 4, 15 days, was 142. Up to April 20 the fry did well, the loss being 7,484, but with increasing temperature the sac was absorbed rapidly, and the fish should have been planted at that time. It was the intention to place them in Woodhull or Bisby Lake, Herkimer County, New York, but my letters remained unanswered because of the absence of the gentleman interested in these waters. We kept the fish until May 13, and the death-rate increased; and I finally decided to plant them on Long Island, after loosing over 38,000 fry. The table annexed will show how the fry were distributed.

(*c*) BROOK TROUT (*Salvelinus fontinalis*).—We received 7,000 eggs from the station at Northville, Mich., on January 31, 1885. The moss was

frozen in places and the eggs were rather dry and badly indented. The loss in eggs was 687, and in fry was 836, total loss 1,523. We delivered 5,500 fry to Mr. George Snyder, Manhasset, Queen's County, New York. We also distributed 22,500 fry, on account of the State of New York, from eggs obtained at the station, and hatched and distributed 100,000 Rangeley (Me.) brook trout for Mr. Francis H. Weeks, of Cold Spring Harbor, N. Y.

(*d*) BROWN TROUT (*Salmo fario*).—On February 24, 1885, I received a package of 40,000 eggs of this fish from Herr von Behr, president of the *Deutsche Fischerei-Verein*, one-half on account of Mr. E. G. Blackford and the remainder to me. The condition of the eggs was good. On unpacking we removed 1,020 dead. There were distributed 28,900, as shown by Table III. I believe this fish to be one of great value to our trout streams.

(*e*) RAINBOW TROUT (*Salmo irideus*).—We received a case of 10,000 eggs of rainbow trout from the Northville station of the U. S. Fish Commission on February 25. Condition, good; loss on unpacking, 498. Another package containing 10,000 was received from the same place on March 9, and 288 dead ones were picked out. From these 20,000 we lost 1,343 eggs and 4,254 fry, and distributed 14,500 fry. (See Table IV.)

(*f*) WHITEFISH (*Coregonus clupeiformis*).—On January 1 we received from the Northville, Mich., station one case containing one million eggs of whitefish in good order. From these we lost 2,445 eggs and 7,500 fry, leaving 99,000 for distribution, as is shown by Table V. In this connection I would say that most favorable reports come from the stocking of Great Pond, near Riverhead, Long Island, but I have not been able to secure specimens. Mr. Nathaniel W. Foster, of Riverhead, president of the Suffolk County Agricultural Society, has written me that small whitefish have been taken from the pond and sent to the New York City markets; and others say that the fish are in the pond, but we lack the absolute proof of specimens.

(*g*) BLUE-BACKED TROUT (*Salvelinus oquassa*).—On February 20 we received a package of blue-backed trout eggs from the Maine Fish Commission, purchased by Mr. Francis H. Weeks, of Cold Spring Harbor. The number of eggs as estimated by the shipper is not known, owing to an error in his mixing the lot for this station with one purchased by Mr. Weeks for the Adirondack Club. We estimate the number at about 7,000; for the number of dead eggs picked out was 3,647 and the fry lost numbered 2,269, while about one thousand were placed in our ponds; but thus far we do not know that a single fish survived.

OTHER WORK.—As this station is leased by the New York State Fish Commission and its expenses paid by them, except those legitimately belonging to the United States in the work of the General Government, there is no necessity of reporting in full the work done for the State. Still it may be well to say that the hatching of smelts has been successful and many thousands have been turned out. In the salt-water department

the hatching of tomcod, or frost-fish (*Microgadus tomcodus*), has met with most encouraging results, while the artificial propagation of oysters has been very successful.

TABLE I.—*Distribution of salmon from Cold Spring Harbor, N. Y., in April and May*, 1885.

Date.	Fry sent.	Loss on way.	Fry planted.	Stream.	Tributary of—	Messenger.
Apr. 27	*60,000	300	59,700	Clendon	Hudson River	F. A. Walters.
May 5	80,000	100	79,900	13th brook	do	Do.
8	70,000	200	69,800	Carr's brook	do	Do.
13	60,000	100	59,900	Cedar River	do	Do.
14	1,000	.....	1,000	Pond near Brooklyn†	Jamaica Bay	P. McGovern.
20	50,000	250	49,750	Paulin's River, N. J	Delaware River	F. A. Walters.
22	50,000	400	49,600	Pequest Creek, N. J	do	Do.
27	50,000	‡4,000	46,000	Oswego River	Oswego River	Do.
30	4,000	100	3,900	Massapequa	Great South Bay	W. S. Stoots.
	425,000	5,450	419,550			

* Also put 150 yearlings in Clendon brook at the same time.
† Private pond of Mr. McGovern, by request of Mr. E. G. Blackford.
‡ Last lot of fish, and were weak.

TABLE II.—*Distribution of landlocked salmon on Long Island from the station at Cold Spring Harbor, N. Y., May*, 1885.

Date.	No. of fry.	Where planted.	By whose order.	Messenger.
May 13	4,000	Pond at Montauk Point	E. G. Blackford	L. I. R. R. Co.'s Express.
22	1,500	Pond of J. Ramsbottom	do	James Ramsbottom.
30	6,000	Pond of John D. Jones	do	W. S. Stoots.
30	8,000	Lake Ronkonkoma	Fred Mather	F. A. Walters.
	19,500			

NOTE.—The pond at Montauk Point is owned by Mr. A. D. Benson and is said to be deep and cold. The pond of Mr. John D. Jones empties into Great South Bay, and the fish can go to salt water if they choose. Lake Ronkonkoma is about 60 feet deep in parts and is said to be cool; we have planted whitefish there. I do not know the character of Mr. Ramsbottom's pond or stream, but think it empties into the Great South Bay.

TABLE III.—*Distribution of brown trout from the station at Cold Spring Harbor, N. Y., in* 1885.

Date.	No. of fish.	Delivered to—	Post-office address.	For stream.	By order of—
Apr. 30	3,000	H. S. Jennings	Islip, N. Y	Near Islip	E. G. Blackford.
May 3	6,000	George Snyder	Manhasset, N. Y	Private ponds	Do.
4	3,000	J. R. Wood	Cold Spring Harbor, N. Y.	do	Fred Mather.
12	2,000	F. H. Weeks	do	Swamp brook	Do.
13	1,700	H. Scudder	Northport, N. Y	do	E. G. Blackford.
15	3,500	Dr. A. K. Fisher	Sing Sing, N. Y	Near Sing Sing	Fred Mather.
21	2,000	A. W. Humphries	Sterlington, N. Y	Sterling Lake	E. G. Blackford.
30	2,200	Weeks & De Forest	Cold Spring Harbor, N. Y.	At Oyster Bay	Do.
	5,500	Townsend & Jones	do	Mill-ponds	Fred Mather.
	28,900				

TABLE IV.—*Distribution of rainbow trout from Cold Spring Harbor, N. Y., in May*, 1885.

Date.	No. of fish.	Delivered to—	Post-office address.	For stream.	By order of—
May 3	1,000	George Snyder	Manhasset, N. Y	Private pond	E. G. Blackford.
4	1,000	J. R. Wood	Cold Spring Harbor, N. Y.	do	Fred Mather.
12	1,000	F. H. Weeks	do	Swamp brook	Do.
13	4,000	A. W. Benson	Brooklyn, N. Y	Pond at Montauk	E. G. Blackford.
14	500	P. McGovern	do	Private pond	Do.
15	2,500	Dr. A. K. Fisher	Sing Sing, N. Y	Brooks at Sing Sing	Fred Mather.
21	3,000	A. W. Humphries	Sterlington, N. Y	Sterling Lake	E. G. Blackford.
22	500	J. Ramsbottom	Baldwin, N. Y	In South Bay	Do.
30	1,000	Weeks & De Forest	Cold Spring Harbor, N. Y.	In Oyster Bay	Do.
	14,500				

TABLE V.—*Distribution of whitefish from Cold Spring Harbor, N. Y., in* 1885.

Date.	No. of fish.	Where planted.	Messenger.
Mar. 4	60,000	Great Pond, Riverhead, Long Island	F. A. Walters.
11	5,000	Mill-pond, Cold Spring Harbor	Do.
Apr. 8	34,000	Lake Ronkonkoma, Long Island	Do.
	99,000		

166.—ON A DISEASE AFFECTING THE RAINBOW TROUT AT McCLOUD RIVER STATION.

By LOREN W. GREEN.

A disease has recently come among our trout which was never known here before, and it has killed several of our largest breeding trout, while the small trout in ponds near by have not suffered at all. The disease has been as bad in the river as in our ponds, and a great many large trout have died in the river. The first symptom of our trout in the ponds was that they refused all food. They would eat heartily one day, and the next refuse all food, and on the following day would be lying quietly on their left sides at the bottom of the pond, where they would remain in this state for about five days, eating nothing, after which they would die. While remaining at the bottom their breathing was a little faster than was natural. If disturbed they would swim away as though well, but only for a short distance, and then turn on their sides again. Nothing can be seen about the outward appearance of the fish to indicate the disease. Their eyes, gills, &c., appear perfectly healthy, and all the fish are fat, but upon opening them there appears around the heart and stomach a yellow substance which seems hard and contracted. Not a trout affected has lived. I have used every means available to prevent the further spread of this disease, and I think that now I have it checked, as the remaining trout are looking very well.

BAIRD, CAL., *September* 24, 1885.

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